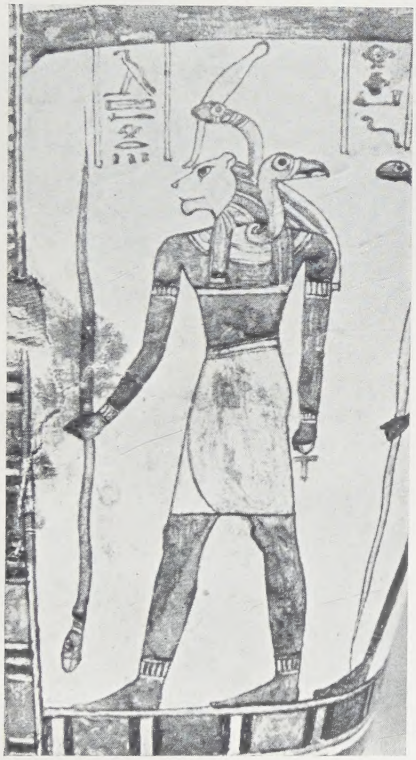
ANCIENT EGYPT AND THE EAST

1934. DECEMBER. PART II.

CONTENTS.



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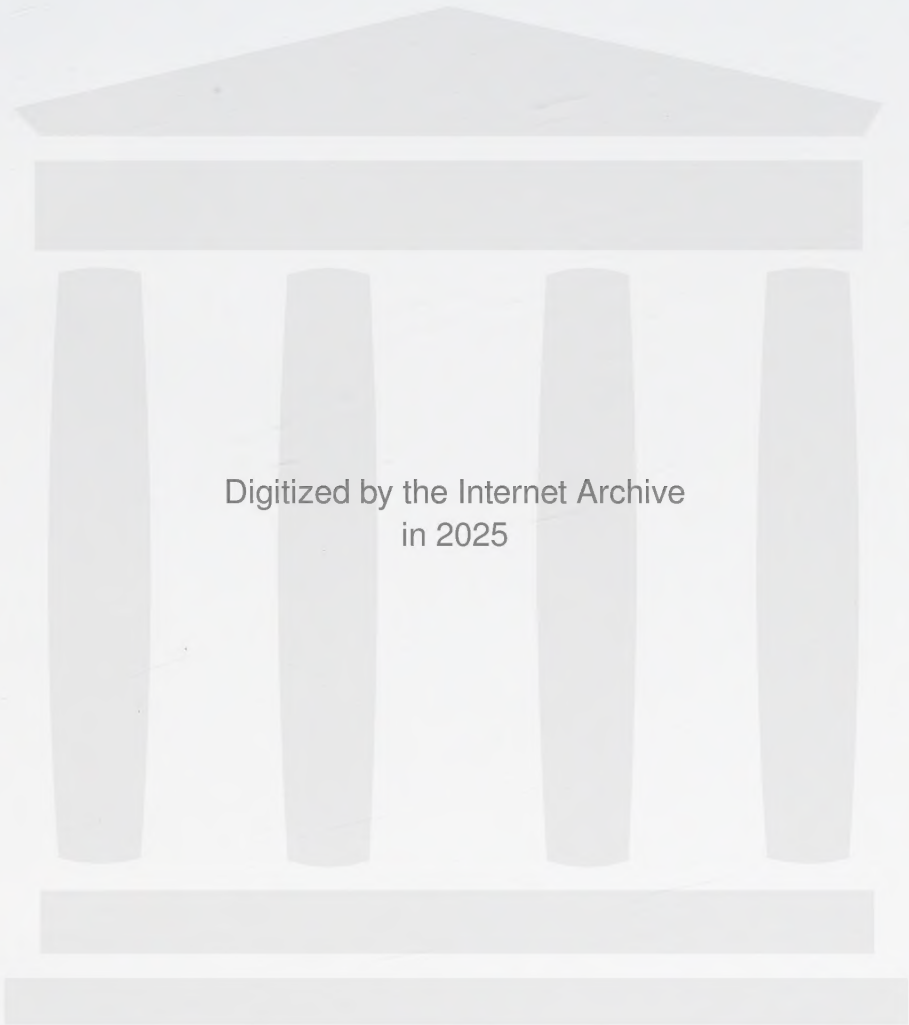


QUEEN TETY-SHERY (SIDE VIEW).

(By Courtesy of the Trustees of the British Museum.)

ANCIENT EGYPT AND THE EAST

QUEEN TETY-SHERY.

(*Continued from p.* 6.)

The back of the statuette of the queen is extremely interesting, both for the modelling of the neck and shoulders and for the method of dressing the hair. It is rare to find undercutting and open-work in Egyptian sculpture, and this is, as far as I know, unique in a royal statue though it occurs in the small figures of the Middle Kingdom, which are often regarded as dolls. The delicacy of modelling in this statuette is not confined to the front of the figure, but is equally fine at the back. The nape of the neck and the set of the shoulders convey the sense of extreme youth as vividly as the face, and show that the sculptor was as true an artist as any of the earlier periods.

The hair-dressing has a singular importance. In the photograph the wing of the vulture can be seen falling down at the side of the face ; the wide tail spreads over the back of the head ; and the claw holds the *shen*-sign. The hair is possibly a wig, but it is equally possible that it is not. A heavy tress falls on each side of the face, the hair is then cut in a curve to arch over the shoulders, which it leaves clear ; and at the back a long tress hangs down to each shoulder-blade. The back of the head is shaved from the neck to above the occipital prominence, and there the long hair of the upper part of the head is turned in over a pad. The effect is that of the royal heads in the art of El Amarna. In

FIG. 1.—INSCRIPTION ON THE BACK OF THE QUEEN'S THRONE.
(*By Courtesy of the Trustees of the British Museum.*)

this statue there is no question of head deformation; the form is clearly due to the method of dressing the hair. The shape of Nefert-yti's head, and perhaps that of her daughters', is probably due to the same cause, but the Amarna ladies wore the pad lower down on the head—below the occipital prominence—and brushed the hair smoothly over the pad; the sculptor was therefore obliged to represent the queen's head as if deformed.

The inscription at the back of the throne (fig. 1) reads *nesi Sen-sneb . . ankh . .* The first words appear to mean "Belonging to Sen-sneb," which seems to refer to the ownership of the statuette. Such an inscription is unique in Egypt; a statue being a religious object had no secular owner. It is possible, however, that Sen-sneb is the name of the sculptor, for the broken part of the inscription was probably *s-ankh ren-s*, "who perpetuates her name." If this be the case, the statuette is one of the rare works of art signed by the ancient Egyptian artist.

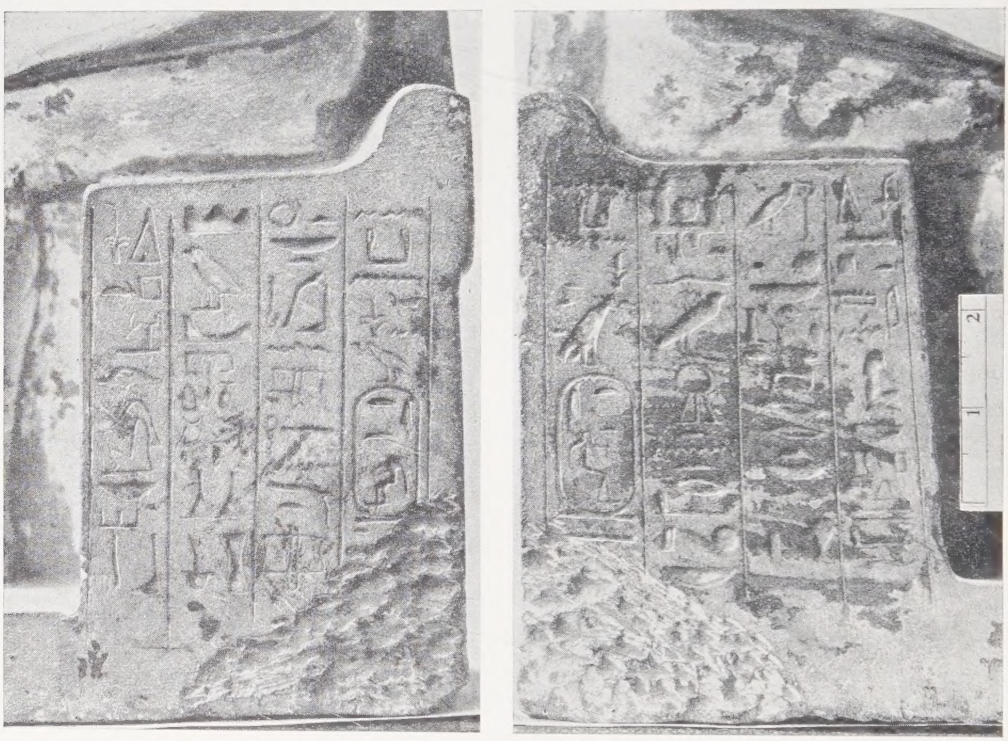


FIG. 2.

(*By Courtesy of the Trustees of the British Museum.*)

The inscriptions at the sides of the throne (fig. 2) have few points of interest. On the left side is the usual prayer to Osiris for food and for the breezes of the North-wind. On the right side, the prayer is to Amon, Lord of Karnak. This god is rare in funerary prayers, and the mention of his name shows that the statuette is Theban in origin; the request is for the daily offerings which "go forth" on the altar of Amon.

The upper portion of a limestone stele (fig. 3) (now at University College, London; published in hand-copy by Winlock in *Ancient Egypt*, 1921, p. 15) bears part of an inscription commemorating the restoration of a temple or a chapel by

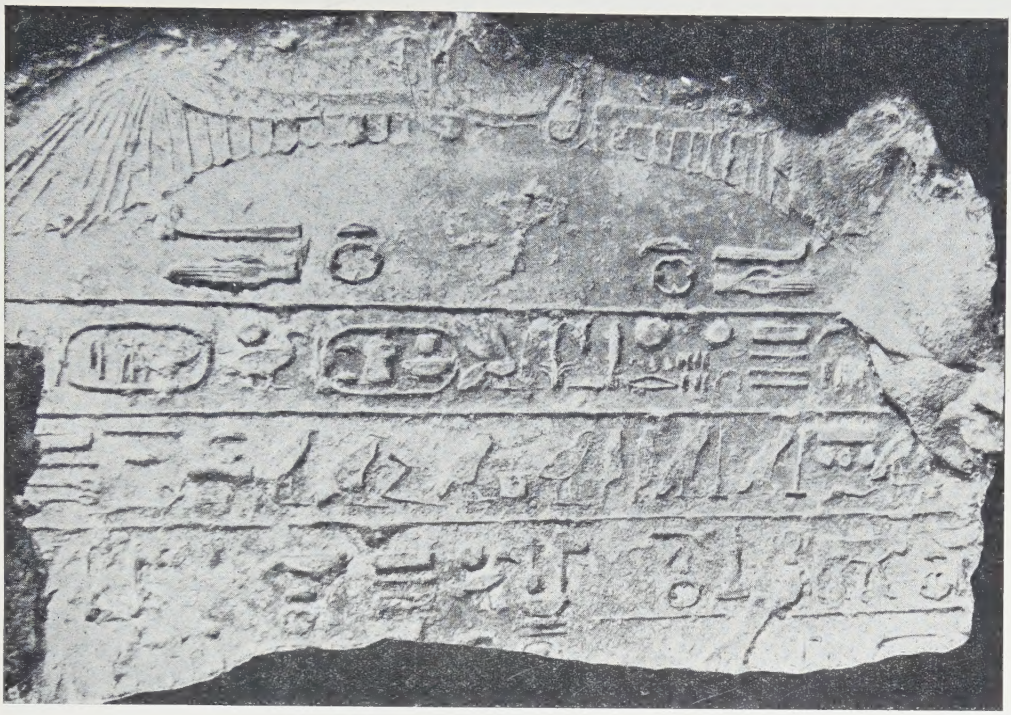


FIG. 3.

Aahmes I, who "built this wall anew as his monument to his father Mentu, Lord of Thebes, the Bull in Hermonthis." The top of the king's white crown is visible, showing that he stands face to face with the god, of whom only the extreme tips of the tall feather headdress remain. Behind the king is the "King's Mother," whose name was in a horizontal cartouche. In this a ⌓ and the tip of a 𓎛 are still visible in such a position that the name can only be that of Tety-shery.

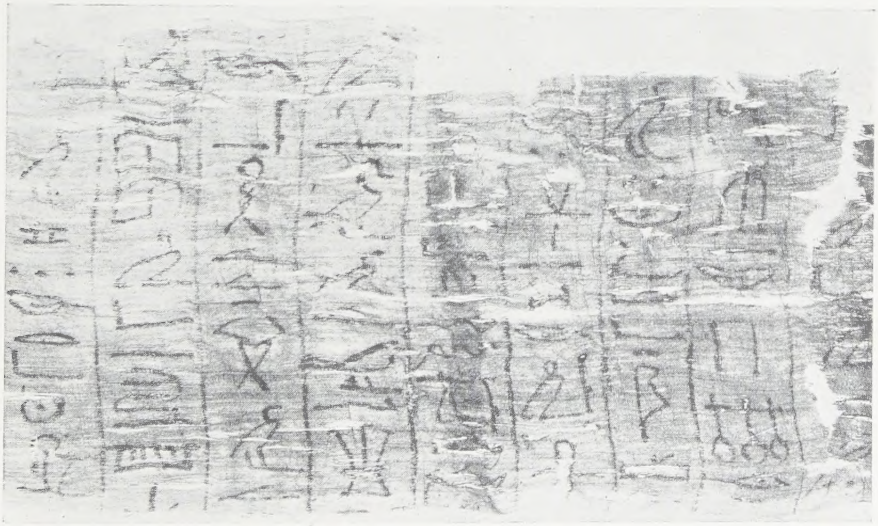
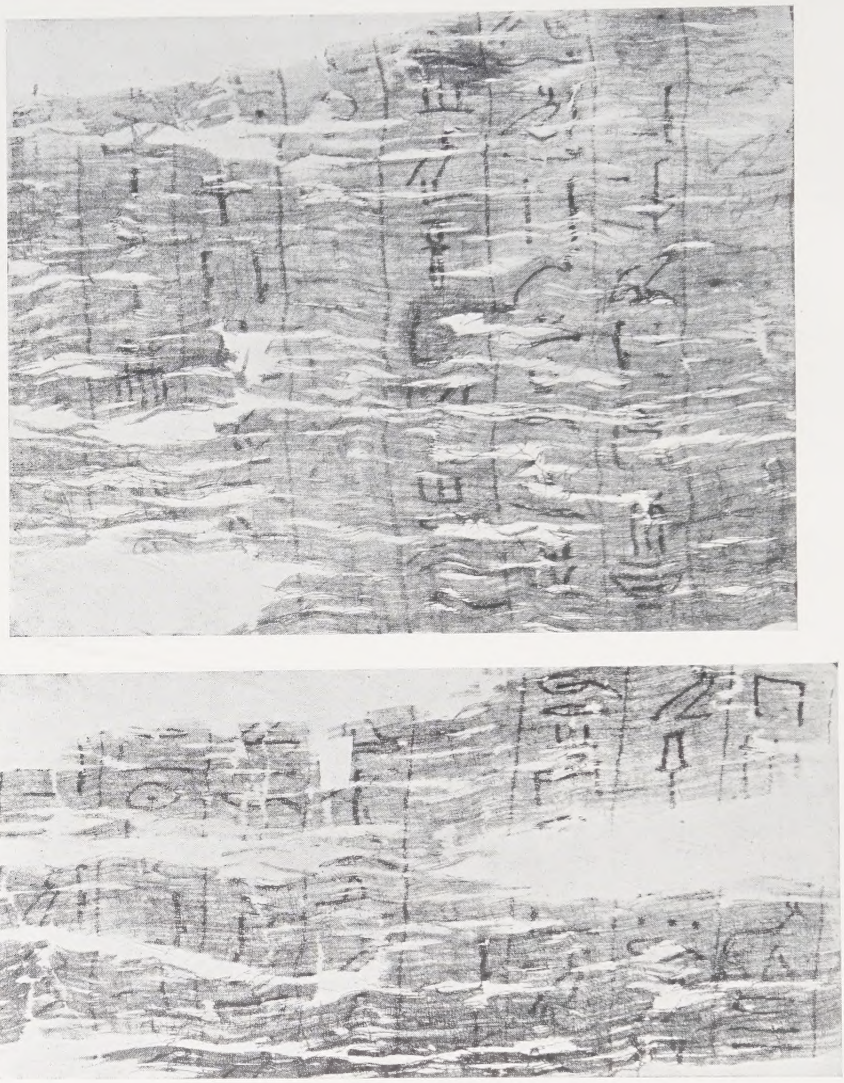


FIG. 4A.
(By Courtesy of the Dept. of Antiquities, Egypt.)

Winlock (*Journal of Egyptian Archaeology*, X, 1924, p. 246) has made a careful study of the history of Tety-shery from the few objects concerning her which still survive. In his article in *Ancient Egypt* quoted above, he calls attention to the importance of Tety-shery during the reign of Aahmes I, and



FIGS. 4B, 4C.
(*By Courtesy of the Dept. of Antiquities, Egypt.*)

also to the fact that at her death Aahhotep became the chief queen, Nefertari succeeding at Aahhotep's death ; " for about a century the royal family was to all intents and purposes a virtual matriarchate." This can be explained if the Kingship was vested in the husband of the queen, marriage with the chief royal lady constituting his right to the throne. In such cases consanguinity in the closest degree of relationship was no bar to marriage. As the number of royal wives does not appear to have been limited, a king could marry all the other heiresses to the crown during the lifetime of the principal queen. It is therefore possible that Aahmes I may have been married to Tety-shery, Aahhotep and Nefertari at one and the same time.

Figs. 4A, 4B, and 4C are the inscribed bandages from the mummy of Tety-shery. The first line on the right in 4A shows only the  of the queen's name, and below are the words, "Born of the Lady of the House, Neferu, begotten of. . . ." Of the father's name only the final letter remains, in the next line. 4B is perhaps the most important for the identification of the bandages with the statuette. In the second line from the right are the words, "The King's mother, Tety-shery, born of the Lady, . . . ," the rest being broken. 4C gives the mother's and the father's names in the first line from the right, "(The Lady) of the House, Neferu, . . . the judge (?) Thenen."

M. A. MURRAY.

NOTES ON GLAZED STONES.

PART I.—GLAZED STEATITE.

Glazed steatite, *burnt steatite*, and *painted steatite* are names which have been applied to steatite which has had its surface altered by some chemical process. This has been done by at least three different methods. The first was to apply a vitreous glaze to the surface and then fire it. This is true glazed steatite; it is hard, and even when the whole layer of glaze is flaked away a very hard surface is left on the steatite. The second method was either to apply an alkali only and fire it, or else to apply a glaze which was of such a nature that it almost always flaked entirely away and left a very soft surface on the steatite. The third method, which is perhaps only a modification of the second, was to whiten the surface, probably with an alkali only, and after heating to paint on a pattern. The effects of the various processes on the stone are different. These processes and the methods of producing some of them are described later.

All the Egyptian specimens of glazed steatite belong to the first type, although a great many have no glaze remaining. The specimens from Taxila also belong to this type.

The seals from Mohenjo-daro and Harappa, some early seals of a similar nature from Kish and Ur, a broken cylinder seal of an early date from Ur, and the great majority of the steatite beads from Harappa belong to the second type; whilst the third type comprises only a comparatively small number of important beads from Harappa.

The first type I call *glazed steatite*; the second has been called *burnt steatite* and for want of a better name I am using this term, although I am not certain that in all cases great heat was used. The third type, *painted steatite*, had a pattern painted with ferruginous clay or some salt of iron on the previously whitened surface. In this case also I am not certain that any great heat had been applied.

The Indus valley appears to have been the great centre for the manufacture of articles of steatite which had the surface whitened by some chemical process. Almost all the animal seals from Mohenjo-daro and Harappa are steatite, as well as the great majority of the beads from Harappa. Not only in their number and variety, but also in their extreme beauty and perfection of execution, they excel the steatite work from all other countries.

Steatite which has been treated in this way has up to the present been reported only from Egypt, Mesopotamia and India. It is a surprising fact that although relatively common in Egypt it has not been found in any of the other countries bordering on the Mediterranean. One would expect also to find it in Persia where numbers of steatite seals are found, but all that I have seen are made of the natural stone with no sign of chemical treatment.

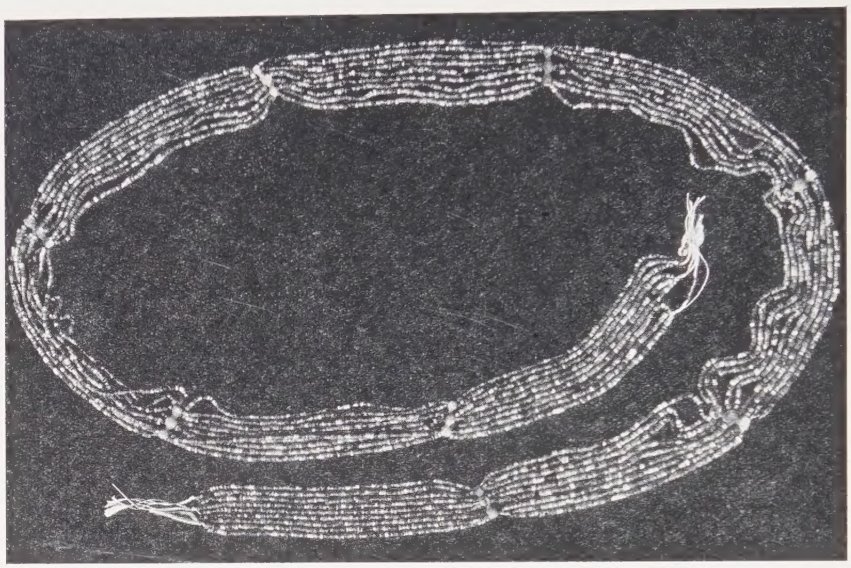


FIG. 1. ($\times \frac{1}{4}$)

A series of specimens ranging over a long period of time have been selected and examined : from Egypt, five Badarian, five Predynastic, one Old Kingdom, one First Intermediate, one XIIth dynasty, and two unglazed specimens (one Badarian and one Predynastic) ; from Mesopotamia, a cylinder seal of an early period, and a bead of the Persian period (c. 500 B.C.) ; from India, two seals and a bead from Mohenjo-daro, and three seals and a large number of beads from Harappa.

These specimens have been specially examined with reference to their hardness, their external appearance, and their internal structure as shown by microscopic sections.

EGYPT.

True glazed steatite is an almost entirely Egyptian product. It appears in the Badarian period, and is earlier than glazed faience which does not appear until Predynastic times. The finest specimen in this period is the great Badarian

FIG. 2.—MATMAR, EGYPT : VI DYN. ($\times 1\frac{1}{2}$)

FIG. 3.—EGYPT : XII DYN. ($\times 1\frac{1}{2}$)

Fig. 4.
Dashur :
XII Dyn.

Fig. 5.
Hemamieh :
XVIII Dyn.

Fig. 6.
XVIII
Dyn.

Fig. 7.—Qau :
XXIII Dyn.

(All × $1\frac{1}{2}$)

girdle (Fig. 1) (British Museum, No. 62150). The process was continued during the Predynastic period, but was chiefly, if not entirely, used for small beads, either cylinder or bi-cone. During the early dynasties up to the XIIth, the process was used extensively for beads (Figs. 2, 3), amulets (Fig. 4), and scarabs. After that beads are rare, but it was still frequently used for amulets (Fig. 5) and scarabs (Fig. 6) up to the XVIIIth dynasty, and continued in use until the XXVIIth dynasty (Fig. 7).

There are a few very fine specimens of Egyptian glazed steatite of considerable size. These date, for the most part, from the XIIth to the XVIIIth dynasty. One of the largest of these specimens is a statue of Tauert, of the XIIth dynasty, at the British Museum (No. 11862) (Fig. 8A). It has a blue glaze. The way in which the glaze has run unevenly is very characteristic of large steatite

A. B.

Fig. 8.

FIG. 9.

specimens. The figure is about $6\frac{1}{2}$ inches high, and dates to c. 2000 B.C. Another example is a steatite vase (B.M. No. 4762) (Fig. 9B) which is unfortunately slightly broken. Great skill must have been employed to make the sides so thin; in some parts they are only ·06 inch thick. The pattern of the stone shows in a very marked way through the glaze, which is green. This specimen has an inscription of Tuthmosis I (c. 1550 B.C.). A seated statuette of Thunera holding Price Teni on his knee (B.M. 35400) (Fig. 9C) is a very fine specimen. An inscription dates it to the time of Thutmosis III (c. 1501–1447 B.C.). The blotchiness of the green glaze is very marked.

The kohl-pot shown in Fig. 9A (B.M. 3723), which probably dates from the XVIIIth dynasty, is so carved that all the front decorated portion stands out with a hollow behind it. The base is a separate piece cemented on. The glaze is green.

Perhaps the finest specimen of all is the head and upper part of a statuette (B.M. 15078) dating from the end of the XVIIIth or beginning of the XIXth dynasty (14th to 13th century B.C.) (Fig. 8B). It represents a high officer of state dedicated to Amen Ra. The glaze is blue. I have not seen any of these rare specimens of a later date than the XIXth dynasty.

Hardness.—Of the Badarian beads tested, four out of five scratched glass easily and the other moderately well; of the Predynastic, one scratched it easily, one moderately well, one slightly, and two not at all. The Old Kingdom bead would not scratch glass, the First Intermediate and the XIIth dynasty beads scratched it easily. The unglazed specimens are altogether softer and can easily be scratched with a pin. The hardness of these is well under 2. Some of the Badarian beads showed great hardness. Specimens from the same girdle as those in Pl. I, 2, 3, were tested against quartz; they distinctly marked a natural quartz surface and were very difficult to scratch with a quartz pencil. This shows that their hardness is practically the same as that of quartz, *i.e.*, 7. Some of the Predynastic and Old Kingdom beads had a hardness of just about 6. As the hardness of the glass used for testing was practically 6, all these glazed beads had a hardness that was between $5\frac{1}{2}$ and 7. Even the softest of them would be so hard that an ordinary knife would scratch it only with great difficulty. Later it will be shown that almost all the beads of burnt and painted steatite have a hardness which ranges from slightly above 3 to not much over 2.

External Appearance.—The external appearance of the glazed surface also varies a great deal in the different specimens. The colour can be blue or green over the whole surface, it can be mottled with white to a greater or lesser extent, or it can be completely white. The surface may be smooth with small pits or depressions in it, but with all the irregularities of the base, if any, hidden by the thickness of the glaze. This is generally the condition of the Badarian specimens, unless the glaze has completely flaked away. The Predynastic examples generally have a very rough base of steatite with coarse marks resembling file marks showing through the glaze. In the specimens I have examined these "file" marks are parallel to the axis.

In the beads of the First Intermediate period, the colouring has so completely disappeared that one almost doubts if they ever were coloured. In these the base has rough "file" marks at about 30° to the axis. The XIIth dynasty bead has a very thick vitreous glaze which almost formed drops and showed signs of flowing.

Internal Structure.—An examination of the sections by means of a microscope shows at once that there is considerable difference in the different specimens. But they all show that the addition of the chemical or glaze used for glazing, and the subsequent heating have completely altered the nature of the stone for some distance in from the surface. The original stones used to make the base are very different. In some cases they are pale, and in some cases dark; some have a very fine structure and some much coarser; and I am not sure that they are all steatite. But whatever glaze or chemical was used, it has had the invariable result of making the layer of affected stone harder, more opaque, and white. It has also greatly reduced the polarising effect of this layer. A possible exception to this is found in the painted steatite referred to under Indian specimens.

This chemically affected surface, whether produced by the glaze or the alkali only, has two curious features when examined as a section under a microscope. First, the white opaque portion is not usually a uniform layer, but has a series of alternating dark and light layers as one goes from the surface towards the base. These vary greatly in intensity in different specimens. The layer furthest from the surface is often the most intense.

Perhaps the clearest example of this is the Badarian bead shown in Pl. I, 1. Here, although all the glaze has broken away, five different layers can be seen before the unaffected portion of the base is reached. On the other hand, in the chemically affected cylinder seal from Ur (Pl. II, 5) the alternating layers are scarcely visible.

The second curious feature is that in most cases there is a thin layer on the surface which has only been affected very slightly, and in some cases perhaps not at all. This is shown in Pl. I, 2, 4, 6, and to a less marked degree in some others. This unaffected surface layer is much more universally and markedly shown in sections of the etched carnelians. In this case only alkali is used, but it acts on the silica in the carnelian. No satisfactory explanation of this unaffected layer has been found.

In the description of the specimens, the layer or layers of glaze are called A; if two layers are present, A.1 and A.2. The unaffected layer is called B; the first dark (opaque) layer is called C.1, and the later ones C.2, C.3, etc.; and the first lighter layer (other than B) is called D.1, and successive similar layers, D.2, etc. E is the unaltered base.

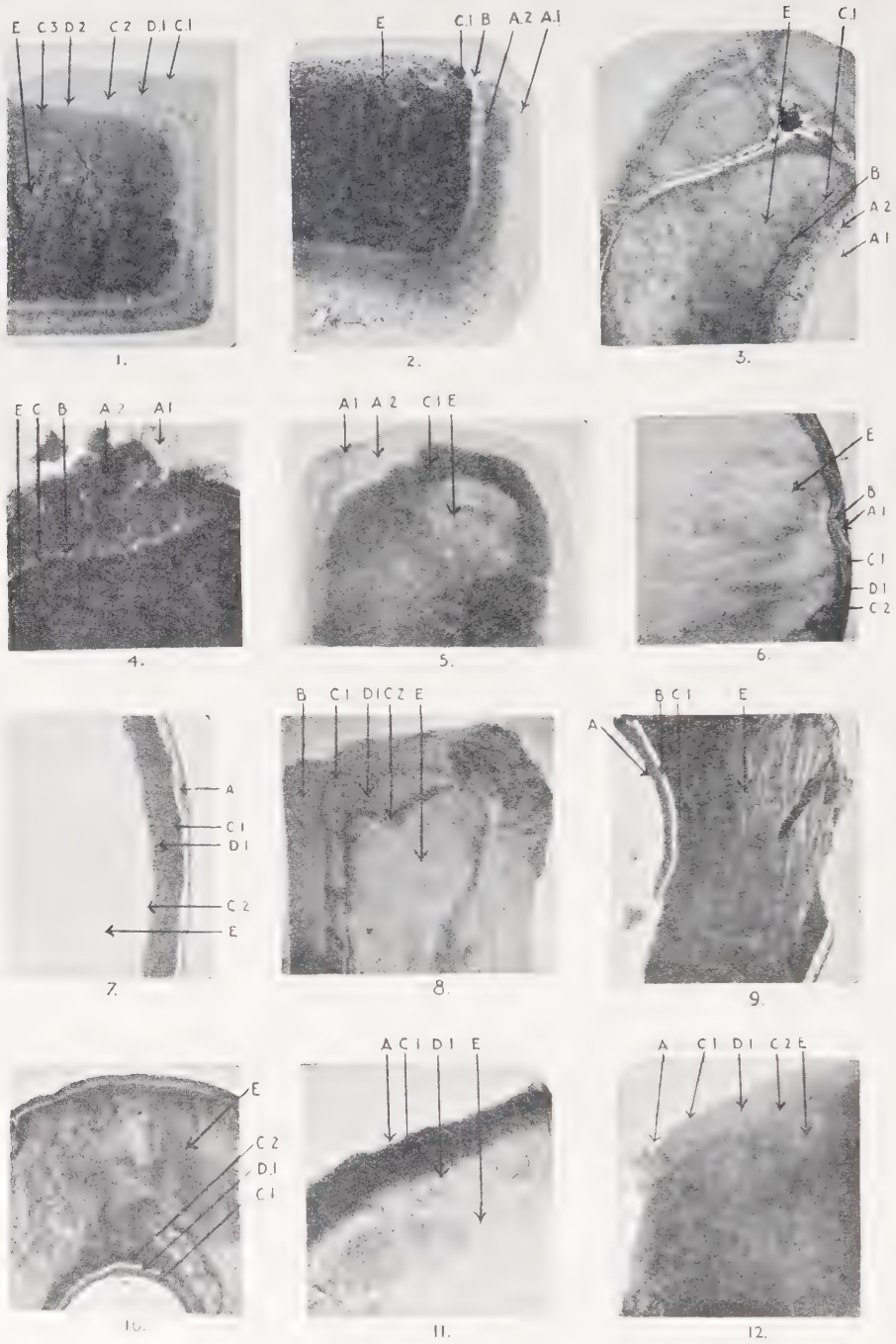


PLATE I.

Glaze. The glaze shows several varieties. First, a glaze which has a large number of crystals which almost entirely fill it. Second, a glaze with a few crystals mixed in a clear glaze which is not isotropic. Third, a clear glaze which is isotropic; that is, pure glass.

It will be seen by reference to the summary of results that all the Badarian beads which have any glaze left belong to the first class, and that one of the Predynastic beads (Pl. I, 7) is the only other specimen which has this variety

of glaze. The remaining Predynastic specimens which have any glaze left are of the second variety, a glaze which is not isotropic as it polarises, and which also contains a few small crystals.

The XIIth dynasty bead is of the third kind, as it is a pure vitreous glaze which does not polarise. The bead of the Persian period from Ur is perhaps an intermediate type; the remains of the glaze are so slight that it is difficult to be certain, but what I take for a thin layer of glaze over a portion of the perforation seems to be a vitreous glaze but to have a few small crystals in it.

The beads with the best glaze are the Badarian, and of these the most typical are those from the Badarian girdle found in 1928 (B.M. 62150). Sections through beads from this girdle (Pl. I, 2–5) show an apparently wide band of blue glaze round a white core. Microscopic examination of this wide, blue band shows that it consists of two layers: the outer, which is about half the width of the whole, is composed entirely of blue crystals which polarise extensively; the inner layer consists of a very much more compact mass with many small crystals in it, many of which polarise. The junction between these two layers of glaze is fairly abrupt. The crystals in the glaze have been identified by Dr. Thomas of the Geological Survey as mullite, which is a silicate of alumina. This very distinct double layer of glaze I have only found in Badarian beads. It is difficult to explain how the crystals are formed, as there is no alumina in most steatite, and a maximum of between 5 and 10 per cent. in any known varieties. This, Dr. Thomas considers, would not be sufficient to make the very extensive crystals found in the Badarian beads. Two possible explanations are either that the stone used is not a steatite, or else that a felspathic glaze has been used, which would make a true porcelain and account for the great hardness. It is the mullite crystals which give the great strength to porcelain.

In this connection it is interesting to note that the Predynastic bead (Pl. I, 7) is the only Predynastic bead tested which has a large number of crystals in the glaze, and that it is the only one which will scratch glass easily, in this way showing the effect of the crystals on the hardness.

Whatever method had been used to produce the glaze or to harden the surface, it had a great effect on the steatite base. In some cases the latter seems to have altered through the complete thickness of the bead, and in others there seems to have been an actual dissolving away of the stone. See, for example, the rounding away of the chip in Pl. I, 3.

Of the five Badarian beads, one has no glaze remaining, and on the other four the glaze consists entirely of mullite crystals. Of the five Predynastic beads, one has no glaze remaining, one has large crystals in the glaze, and three have a few small crystals in a clear glaze which is not completely isotropic. From this it appears that the Badarian beads are better than the Predynastic as regards hardness, shape of the stone base, and quality of glaze. This may be due to the use of a different stone, or to some different process; but the Predynastic beads are so similar in some ways that I do not think it would be safe to attempt to date beads by this method. At the same time, it is rather striking that all the Badarian glaze examined should be so much more crystalline than the Predynastic.

In order to see if any of the alteration of the steatite was due to the time that elapsed since they were made, I selected two unglazed steatite beads, one Badarian and the other Predynastic, and cut sections (Pl. II, 3, 4). The micro-photographs of these show that no alteration can be detected.

Mesopotamia.

Beads of glazed or burnt steatite are not common in Mesopotamia from early sites. At Ur almost the only specimens dating before the Persian period are the minute beads from the grave P.G. 55. This grave, which unfortunately had been plundered, was originally very rich and may have been a royal tomb. It was found in the old cemetery and is dated by Dr. Leonard Woolley to the fourth millenium B.C. These steatite beads were associated with a great number of carnelian and lapis-lazuli beads, not much larger, and are supposed to have formed a girdle. Some of the beads are extremely small, about .04 in. in diameter and .024 in. long. A number of beads of a very much rougher nature, also found at Ur, are dated to the Persian period.

Whilst digging in the great pit at Nineveh during the 1931–32 expedition, Mr. M. E. L. Mallowan and Dr. R. Campbell Thompson found a large number of small burnt steatite beads. The earliest was a single specimen at 63 feet below the datum line. This is in the period they call Ninevite II. In the next period, Ninevite III, in a child's burial 44 feet below the datum line, about 50 of these beads were found together with about 20 black beads which had not been burnt (Fig. 10). These were all small cylinder or barrel beads. At the same depth some larger beads of different shapes were also found (Fig. 11). In Ninevite IV some hundreds of these beads were found. In all cases the beads from Nineveh appear to have been made from a dark stone which had been whitened by treatment.

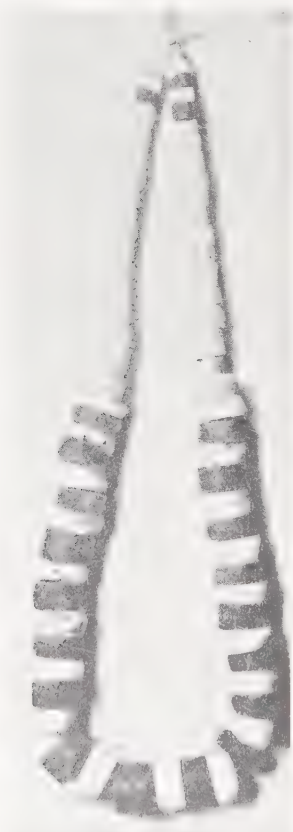


Fig. 10.—From Nineveh. ($\times 1\frac{1}{2}$)

Fig. 11.—From Nineveh. ($\times 1\frac{1}{2}$)

By far the most important specimens of steatite found in Mesopotamia are a few seals found at Ur and Kish (C. J. Gadd, *Proceedings of the British Academy*, XVIII, 1–22). These have a style of design closely connected with designs on seals found in the Indus valley at Harappa and Mohenjo-daro and provisionally dated to 2750 B.C. There is strong evidence that these seals from Ur were not made there, or at Mohenjo-daro or Harappa, but that they came from some site at present unknown. All these seals are not glazed, but "burnt."

A seal similar to these, but of unknown provenance, is made of a dark steatite. It is supposed to have come from the same source as the Mesopotamian seals, as the shape and design are similar; the workmanship, however, is very inferior. The surface of the seal shows no sign of having been treated chemically; in some of the grooves, however, there are brown marks which may be the remains of chemical treatment.

A cylinder seal which had been "burnt" was found at Ur. It is not accurately dated, but from its design it evidently belongs to an early period.

Hardness.—The hardness of the beads and seals from Mesopotamia is very much less than that of the Egyptian beads. The early beads seem to be very slightly softer than those of the Persian period, but both are about 3.

External Appearance.—None of the Mesopotamian burnt steatite beads or seals has any trace of colour. Those from the early period are almost all carefully finished, but the later ones which date to the Persian period are extremely rough.

The technique of beads from Mesopotamia appears to be identical with that of beads from the Indus valley described later.

Internal Structure.—The photographs, Pl. II, 5 and 2, show the structure of an early cylinder seal and a bead of the Persian period, both from Ur. The former has very little of the affected portion remaining, whilst the latter is very similar to Indian specimens. The question of the structure of *burnt steatite* is discussed with the Indian beads.

India.

A careful examination of six seals and several hundred beads from Mohenjo-daro and Harappa convinces me that a different method was employed there from that used in Egypt. It also makes me think that more than one method was employed in the Indus valley.

Hardness.—The difference between the Indian and Egyptian beads is most clearly shown by their difference in hardness. The former, with one exception, have a hardness of 3, whilst the hardness of the latter is between $5\frac{1}{2}$ and 7. The difference in hardness cannot be attributed to great age, though the hardest Egyptian beads are the Badarian, which are much earlier than those from the Indus valley.

The *painted steatite* beads, however, vary considerably in hardness. Most of them are under 3; the softest seems to be only a little above 2, but one small bead is a little over 5.

External Appearance.—A careful examination of the surface of the seals does not show any signs of a blue glaze having been applied, but some of them show a brown discoloration of part of the surface which suggests the colour on some of the "painted" beads. The surface seems in absolutely perfect condition and has no tendency to rub away. The workmanship of these seals far surpasses

FIG. 12.

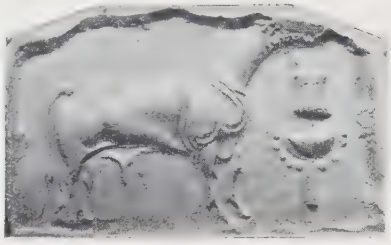


FIG. 13.

FIG. 14.

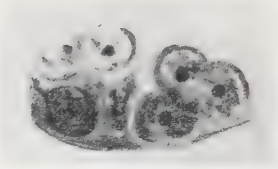


FIG. 15. ($\times 1\frac{1}{2}$)

ALL FROM HARAPPA.

any work done on steatite elsewhere, and both for design and execution compares very favourably with the best Greek work. Figs. 12, 13 and 14 are three broken seals from Harappa. Over 500 seals have been found at Mohenjo-daro or Harappa, with some of their designs very similar to those on the seals (p. 77) from Ur ; but they are more varied and their shape is different. The beads, however, vary greatly. A few, in most cases the more elaborate ones (Fig. 15), have a very similar surface to the seals, but the majority have a softer surface which tends to become powdery. Also, although most of the beads are now white, a few have quite large patches of blue or green material which appears to be a glaze, and a larger number have brown patches that seem to be the remains of a broken-down glaze. Neither the green nor the brown form of glaze is found on the beads which have a surface resembling the seals.

A flake of this glaze examined under a microscope (M.S. 987) has a fairly bright blue colour, is transparent without many impurities, is isotropic, is iridescent, and in every way appears to be a true vitreous glaze ; but the bead from which it came has a hardness of considerably less than 3. I think that the majority of the beads from Harappa have had some glaze of this sort, and that it is the flaking away of this glaze that leaves the very powdery surface.

In a number of experiments I found that any form of vitreous glaze added to steatite raised the hardness to at least $5\frac{1}{2}$, whether the glaze had flaked off or not. Also that usually the greater the heat used, provided some alkali was present, the harder the stone became and the whiter the surface. I have not been able to find out how the beads with a pure white surface, remains of a vitreous glaze, and a hardness of only 3 were made.

Only two of the beads that I have examined came from Mohenjo-daro. They were much bluer than any steatite beads from Harappa, and had a different technique. The blue material is very difficult to diagnose. It shows no signs of being vitreous, but seems to be an aggregate of a great number of minute transparent particles which have a green appearance by transmitted light when

viewed under a high magnification. In the section (Pl. II, 8) it shows as an extremely narrow transparent patch at the bottom of the right-hand side. The surface is soft being under 3, and the colour is easily rubbed off.

One very attractive form of treated steatite, up to the present only found on sites of the Indus civilisation, is *painted steatite.* I have seen eleven beads with this technique from Harappa (Fig. 16). These apparently had the surface first whitened and then the pattern painted in red or brown. As the colour in many specimens goes over a great part of the surface leaving comparatively narrow white lines between, it looks at first sight as though the coloured portion was the background and that the pattern was painted on with white paint.

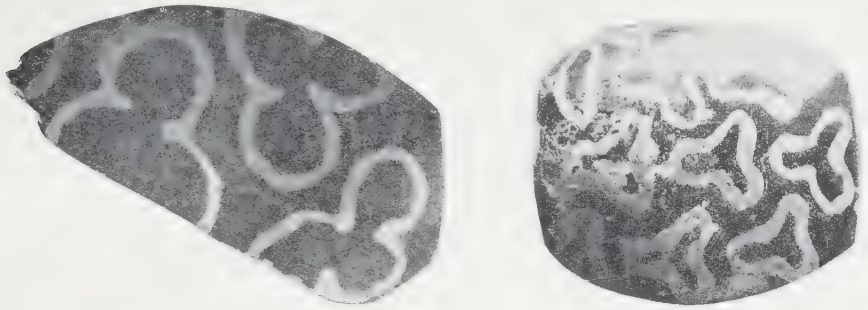


FIG. 16. FROM HARAPPA. ($\times 1\frac{1}{2}$)

As already stated, all except one of the eleven "painted" beads examined were very soft, having a hardness of 3 or less. A section through one of these beads shows that the colouring matter is in a thin opaque layer on the surface. It differs from the ordinary opaque layers of glazed or burnt steatite by showing, when viewed with light from above, as a brilliant red material instead of a white one. The thickness of the layer in the specimen examined is ·0003 in. The colour is probably caused by first painting the specimen with a ferruginous clay, or some other salt of iron, such as nitrate of iron, and then firing it. I made numerous experiments with these and other materials, but although I got effects very nearly (but not quite) the same in appearance, my specimens were always harder and the internal structure was different.

This makes me think that perhaps they were made without using excessive heat, but were baked at a moderate heat for a prolonged period. Another fact which makes me favour the last suggestion is that in some specimens the colour is not thoroughly fixed, so that a quantity of it can be dissolved in pyridine. I found that if I took a bead in which the colour was soluble and heated it to a bright red heat it made no apparent difference to the colour of the bead, but it made the colour much less soluble.

Whilst endeavouring to reproduce painted specimens, I found that in order to prevent the effect of the clay solution or nitrate of iron from spreading over the unpainted parts of the specimen, it was necessary to have some form of stopping-out. I found that if the white pattern was painted with vaseline it was quite successful.

In India, in addition to the early seals and beads, a glazed steatite bead representing an elephant has been found at Taxila. This has been dated to the 3rd century A.D. and is, I think, of Indian manufacture.

Internal Structure.—Over twenty sections of steatite seals and beads from the Indus civilisation have been examined. These all show that the original

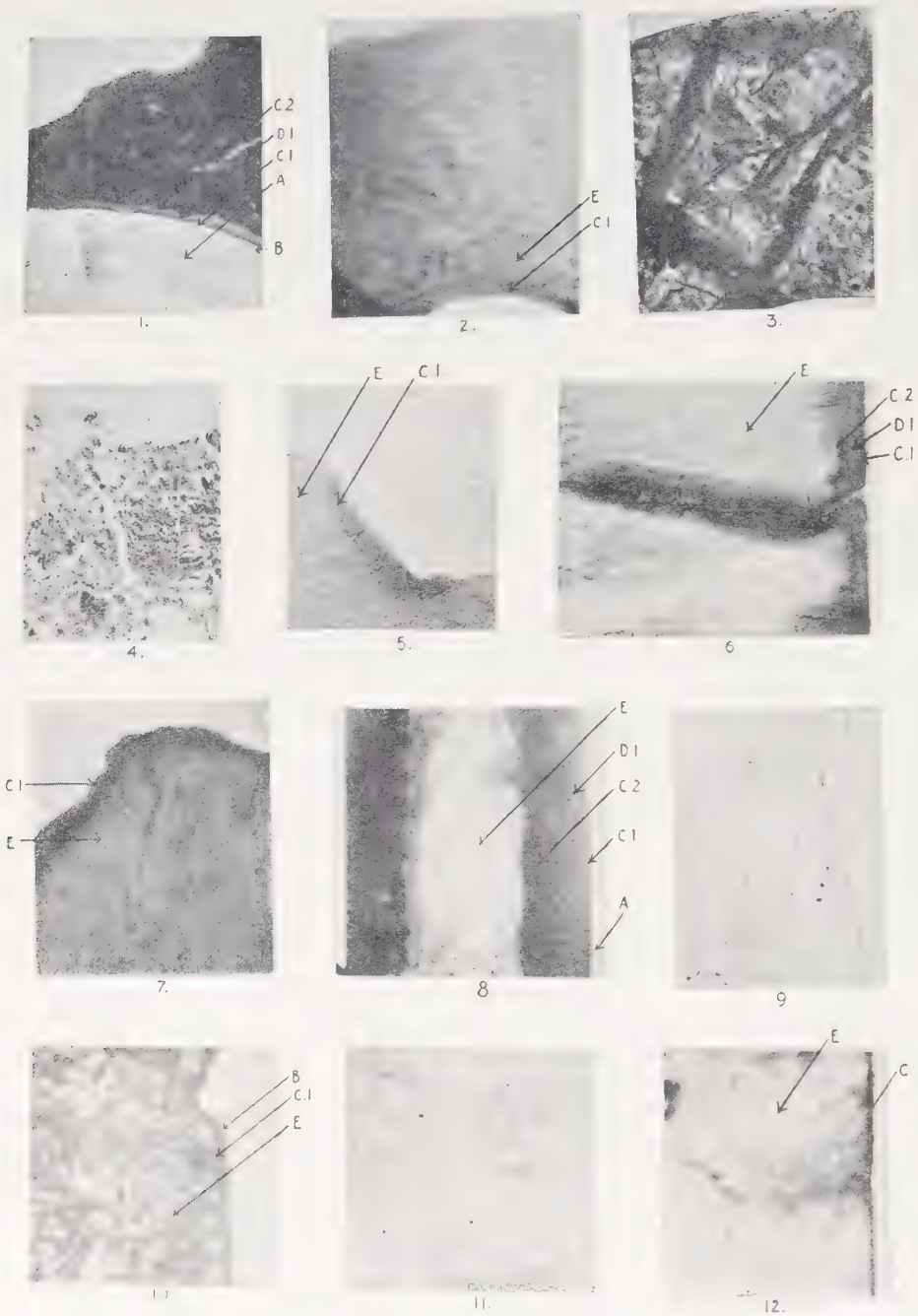


PLATE II.

stone extended to the surface of the specimen. The beads are sometimes referred to as being made of a steatite paste (Sir John Marshall, *Mohenjo-daro and the Indus Civilisation*, p. 515, footnote), and the seals as having been carved in steatite and then finished off with a paste (*Op. cit.*, p. 379). This opinion was formed because so many of the specimens had a layer of white on the surface which flaked away very easily. A microscopic examination of three typical seal fragments shows that in these instances the surface had not been added as a paste, but that the seals had been carved completely from a block of steatite,

and then treated with an alkali and heated. This is very well shown in Pl. II, 6, where the section shows a small crack in the steatite base, which reaches to the surface. The affected layer penetrates to a considerable distance from the surface, and to approximately the same distance on each side of the crack throughout its length. The crystalline structure of the steatite base is clearly visible continuing throughout all the affected area; this would not occur if the affected layer had been put on as a paste, nor could it in that case extend up the crack.

In the hope of finding out the exact treatment which these specimens had received, I tried a few experiments. I first cut a piece off a seal of early date from Nihavand. Part of this I made into a microscope section (Pl. II, 9), in which the surface showed no difference from the base. The other part I heated until it was red hot; a section from it (Pl. II, 10) shows very clearly a thin clear layer on the surface (B) and an opaque band below (C.1). The effects of polarising and illuminating from above were the same as in the Indian seals. The stone that this bead was made of may be a chlorite and not a steatite.

In order to carry out some experiments on a better basis, I got some very clear, white steatite and cut a section from it (Pl. II, 11). I then treated a portion of the same steatite with soda, heated it, cut a section, and obtained the result shown in Pl. II, 12. In this case, the effect does not go so far into the surface, but the narrow band (C) is extremely opaque. Another piece of the same stone was treated with salt and heated. This gave a rather deeper layer, and a slight tendency to light and dark layers. All the pieces of steatite and chlorite treated with alkali and heat only developed a hardness of approximately 3.

I then tried to add a glaze, using a piece of steatite, soda, and a bit of glass broken from a 3×1 microscope slip. I could not get my glaze sufficiently hot to flow properly, but it did flow over a portion of the surface. This glaze was very brittle and full of bubbles, and most of it broke away whilst the section was being made. The result is shown in Pl. III, 2. The glaze is so transparent that it is scarcely visible, except on the lower part of the section. Below it is a curious lattice-like layer, and beneath that a wide opaque band. The hardness was approximately 6.

It has been said (Bauerman, *A Text Book of Descriptive Mineralogy*, p. 222, footnote) that a steatite paste made by mixing finely powdered steatite and water becomes, when heated, a very hard, compact material. Several experiments that I have tried failed completely to fuse it together, and the least touch reduced it to a powder. Dr. Thomas, of the Geological Survey, confirmed this, and said that under these conditions pure steatite would not fuse, but that if the steatite was very impure and contained a quantity of felspar it probably would fuse. I think it probable that Bauerman accidentally omitted to say that a flux was used.

It has been pointed out (Sir John Marshall, *op. cit.*, p. 576, footnote) that a steatite paste formed by mixing finely powdered steatite and silicate of soda can be fused. This can be done by heating either to a red heat for a short time or to the low temperature of 100° C. for a couple of hours. In both cases the material is considerably harder than the face of the Mohenjo-daro seals. An examination of a microscopic section shows that the structures are quite different.

In the same book it is stated that fragments of two steatite faience vases have been found at Mohenjo-daro. This is most important as nothing of the

FIG. 17.

sort has been reported from other sites. In Egypt, as I have pointed out elsewhere (Qau and Badari, II, 23, footnote), some of the crumb beads have particles of steatite instead of the usual crumbs of quartz. As I thought that these might have steatite faience bases, I cut a section of one of the specimens shown in Fig. 17 (VIIth to VIIIth dynasty, c. 2500 B.C.). The section showed that the faience base contained a great number of quartz particles of various sizes, but no trace of steatite. Dr. Thomas confirmed this for me, and said that all the crystalline material in the faience was quartz. He also thought from the condition of some of the grains that they had been heated until the outside reached a temperature of 1100° C., but that the inner part of the bead did not appear to have been heated so much.

It is not obvious why these beads were treated in this manner, but it was probably to increase their hardness. In all cases the steatite articles which have been chemically treated, whether with glaze, alkali, or paint, show an increase of hardness. In the specimens which have a true glaze, like the Egyptian, this increase is very great, from $1\frac{1}{2}$ to $5\frac{1}{2}$ or more. The ordinary burnt specimens which have not had a glaze have a hardness of about 3. This is the same for the

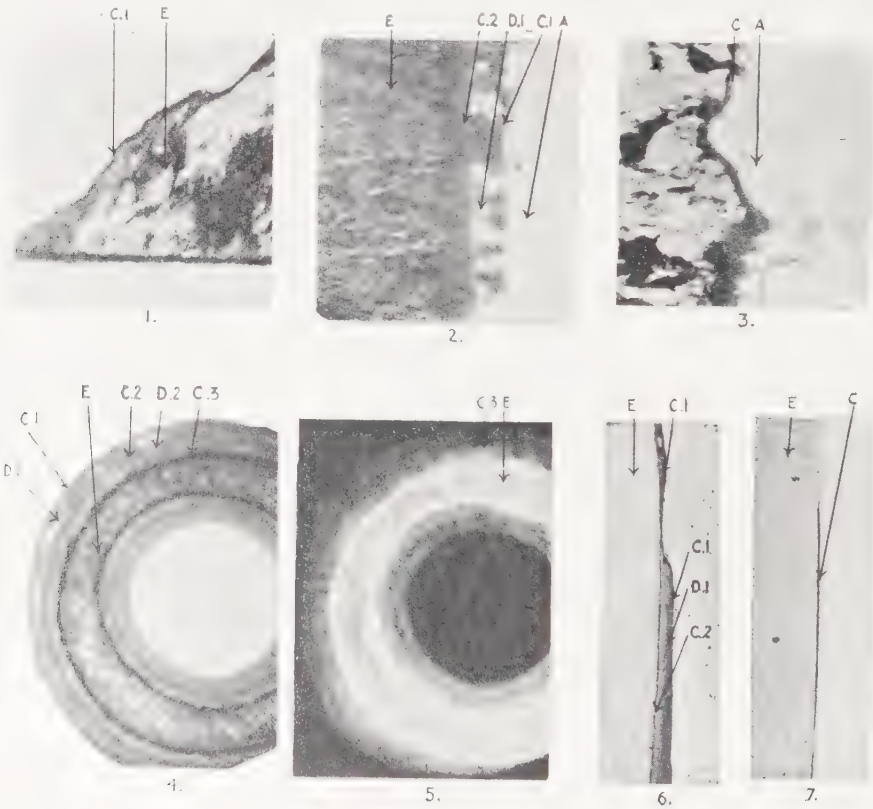


PLATE III.

burnt specimens which have traces of glaze remaining, whilst some of the painted specimens, which are the softest, still have a hardness of over 2.

The illustrations in Plates I and II and most of those in Pl. III are micro-photographs of sections of the beads already referred to. Although all the figures with the exception of Pl. III, 5, were photographed with ordinary illumination by transmitted light, each specimen has also been examined by polarised light, and by light reflected on to it from above.

The section shown in Pl. III, 4, is from a typical Harappa bead, and No. 5 shows the normal effect of light reflected by the ring illuminator. In this it is seen that all layers that look dark when seen with transmitted light become white when viewed by reflected light. The darker they are by transmitted light, the whiter they are when viewed with light reflected from above. This shows that the opacity is caused by numerous particles of white opaque material.

The only specimen in which the dark band does not appear white when viewed with light from above is the painted steatite bead in Pl. III, 7. In this case the opaque band appears brilliant red when viewed by reflected light.

Any variations from the normal effect are mentioned on the attached chart.

The specimens were examined with a 16 mm. apochromatic objective and a ×6 compensating eye-piece. The illumination was obtained in the following ways: that called ordinary illumination, by the use of a low voltage electric lamp as a source of light, and in the sub-stage an achromatic condenser slightly out of focus; for the polarised light the same arrangement was used, but, in addition, a nicol-prism was placed below the condenser and a tourmaline above the eye-piece, the nicol and tourmaline being crossed so as to give a dark field; for reflected light the Beck ring illuminator was used, combined with the Bracey colour corrector to correct the colour aberration of the illuminator.

The blue colour of the blue glaze of the Egyptian beads referred to in many cases became a green.

In conclusion, I am greatly indebted to Mr. Guy Brunton, O.B.E., who very kindly procured for me many of the Egyptian specimens; to Dr. Ernest Mackay for the fragments from Mohenjo-daro; to Dr. Leonard Woolley for specimens from Ur; to the British Museum, for permission to publish various specimens; to Dr. H. H. Thomas, of the Geological Survey, for his assistance in recognising different minerals; and to the Indian Archaeological Survey for sending beads for me to examine.

HORACE C. BECK.

ARTIFICIAL EYES IN ANCIENT EGYPT.

SCATTERED throughout the literature of Egyptology there are numerous references to the materials composing the inlaid eyes of coffins, mummies, mummy masks, statues and statuettes.[1] As the writer has had opportunities from time to time of examining a large number of these eyes, it has seemed of interest to compare the observations made with those of others.

Before describing the ancient imitation eyes, the visible parts of the human eye may be mentioned. These are (*a*) the *white* of the eye, which is that part of the outer or sclerotic coat of the eyeball that is usually seen; (*b*) the *cornea* which is the circular, transparent, colourless front of the eye, through which the light enters and which is continuous with the sclerotic coat, but projects a little beyond it since it has a slightly greater convexity than the rest of the eyeball; (*c*) the *iris*, or coloured annular curtain behind the cornea, which expands and contracts and so causes the pupil to dilate or narrow, as the case may be; and (*d*) the *pupil*, which is the circular opening in the middle of the iris that appears to be black because beyond it is the dark interior of the eye.

Simple inlaid eyes consisting usually of small white shell beads date from Predynastic times,[2] [3] but the earliest inlaid eyes of the kind under consideration known to the writer are of the IVth dynasty, though the IIIrd dynasty limestone statue of Zoser in the Cairo Museum almost certainly originally had inlaid eyes which have been gouged out.

The eyes examined will be described in chronological order, but it should be mentioned that in a few instances a partial examination is all that has been possible, sometimes because naturally the eyes could not be removed from their sockets for a complete examination, sometimes because the light in the museum was poor and it was impossible to obtain a clear view of the details, even with the aid of an electric torch, and occasionally because it was inconvenient at the time for a particular large museum case to be opened.[4]

OLD KINGDOM.

The Old Kingdom inlaid eyes are of two entirely different kinds, which will be distinguished as Class I and Class II respectively.

Class I.

These eyes are admirable imitations of the natural eye and no better ones were made at any period.

Eyelids: a narrow copper rim surrounding the eyeball.

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[1] So far as is known artificial eyes were not used by the living.

[2] W. M. Flinders Petrie, *Prehistoric Egypt*, pp. 6, 7.

[3] Early objects in the Cairo Museum having inlaid eyes: No. J.52839, human figure with eyes inlaid in black material; No. J.57562, fish palette with one white inlaid eye probably not a bead; Guide No. 6201, ivory human figure with eyes of inlaid white ring beads.

[4] I have to thank the Curator and Assistant Curators of the Cairo Museum for much help.

Eyeball: (*a*) polished opaque white quartz, or (*b*) polished crystalline limestone. Sometimes the limestone is banded in the manner of alabaster (calcite), in which case it undoubtedly is alabaster; but sometimes it is without any special distinguishing features, when it may be either alabaster or marble, though generally alabaster. Since, however, both these materials are crystalline limestone, this name may correctly be applied to either and it is particularly appropriate when there is any doubt which of the two it is.

Cornea: transparent quartz (rock crystal), polished at the front, but matt (*i.e.*, like "ground" glass) at the back and edges.

Iris: there is no separate iris, but the effect of an iris is produced either simply by the matt surface of the back of the cornea or sometimes by the material immediately behind the cornea, as dimly seen through the matt surface. Whether this material (when present) is dark brown resin, as in the case of many of the Middle Kingdom eyes, could not be determined without damaging the object.

Pupil: a small circular recess drilled in the middle of the back of the cornea and filled with a plug of very dark brown or black material.

Examples: (1) the eyes of a painted limestone statue of a squatting scribe (IVth dynasty); (2) the eyes of the statue of Rahotpe and Nofret (IVth dynasty); (3) the eyes of the "Sheikh el-Beled" (Vth dynasty); and (4) the eyes of a wooden bust of a man (Vth dynasty).[1] All these examples are in the Cairo Museum and have been examined as closely as was possible.

Scribe. Maspero states [2] that "the eyes are inlaid, the alabaster and crystal composing them are set in copper lids; a small splinter of ebony behind the crystal imitates the pupil. . . ." The eyeballs, however, are not alabaster, as stated, but opaque white quartz; and no evidence is given to prove that the pupils are ebony and it seems probable that they may be some other material, such, for instance, as the dark brown resin that was employed for the pupil of similar eyes in the Middle Kingdom.[3] Naturally the cornea could not be removed for the examination of the pupil, but the recess at the back and the dark brown or black filling can clearly be seen. That the pupil in such eyes was ever the head of a copper nail, as is sometimes stated, is most improbable and no evidence for this can be found. The copper rim is now covered with a green coating consisting of the products of the corrosion of the metal, which is very disfiguring. The iris cannot be seen clearly.

Rahotpe and Nofret. The eyeballs are opaque white quartz; the cornea is rock crystal; the iris cannot be seen very clearly, but appears to be partly brown and partly grey.[4]

"Sheikh el-Beled." Maspero states [5] that "The eyes were inlaid. . . . They are made of a piece of opaque white quartz, with a frame of bronze surrounding it to imitate the lid; a small disc of transparent rock-crystal forms the iris, while a tiny spangle of polished ebony [6]—not silver as has been said too often—fixed

[1] No. C.G. 32.

[2] G. Maspero, *Guide to the Cairo Museum, Trans.*, J. E. and A. A. Quibell, 1910, p. 54.

[3] See later.

[4] See No. 52945 (Middle Kingdom).

[5] G. Maspero, *Op. cit.*, p. 52.

[6] See previous remarks about the ebony.

behind the crystal imparts to it a lifelike sparkle." The rock crystal, however forms the cornea and not the iris, and that the frame should be bronze at that early date is most improbable, copper being much more likely. Baedeker rightly says [1] that the " eyes consist of pieces of opaque white quartz with copper frames to imitate lids," but is wrong when he states [1] that " small discs of rock-crystal form the pupil," the rock crystal, as already mentioned, being the cornea. Petrie refers to the " eyeball of stone and crystal in a copper frame." [2] The iris cannot be seen clearly.

Wooden Bust. The rims are copper; the eyeballs are crystalline limestone; the cornea is transparent rock crystal; and the iris, which is grey, is merely an optical effect principally produced by the matt surface of the back of the cornea [3]: no pupil can be seen.

Class II.

These eyes are neither so elaborate nor so effective as those of Class I.

Eyelids: a narrow copper rim surrounding the eyeball.

Eyeball: polished crystalline limestone.

Cornea: none.

Iris: none.

Pupil: a large circular or oval piece of obsidian, curved and polished on the outside and attached to the front of the eyeball. Although the nature of the material has not been proved by analysis, there is a considerable amount of circumstantial evidence that it is obsidian. Thus, it has all the appearance of obsidian, which was well known in Egypt and had been employed for various purposes from predynastic times, and the only alternative would be black glass, the use of which in the Old Kingdom would be most improbable. Further, in those of the pupils that it has been possible to examine closely, the numerous small air bubbles that are such a constant feature of Egyptian glass are absent, as are also all signs of the surface corrosion that is so frequently found in ancient Egyptian glass and that occurs in some of the glass eyes of Roman date; the surface also shows fine lines caused by the abrasive powder used for grinding and polishing, whereas similar pupils of glass are generally, if not always, moulded.

Examples: (1) the eyes of the large copper statue of Pepi I and of the accompanying small statue (VIth dynasty); and (2) two loose eyes from a coffin found at Zawyet el-Amwât (Old Kingdom). These are in the Cairo Museum and have been examined so far as was possible.

Pepi Statues. Wainwright states [4] that " The use of obsidian as an inlay representing the pupil and iris of the human eye began with the Pepi statues of the VIth dynasty"; Quibell and Green state [5] that " The pupil, a disc of black stone, probably obsidian, is set in an eyeball of white limestone"; and Petrie refers to the " white limestone eye of the statue," [6] though which of the two statues is meant is not clear. The nature of the eyeballs was not determined. The rims are copper.

[1] K. Baedeker, *Egypt and the Sudan*, 1929, p. 90.
[2] W. M. Flinders Petrie, *The Arts and Crafts of Ancient Egypt*, p. 33.
[3] See No. 52945 (Middle Kingdom).
[4] G. A. Wainwright, *Obsidian in Ancient Egypt*, 1927, p. 89.
[5] J. E. Quibell and F. W. Green, *Hierakonpolis*, II, p. 46.
[6] W. M. Flinders Petrie, " The Portraits " in *Ancient Egypt*, 1915, p. 48.

Coffin Eyes from Zawyet el-Amwât. The eyeballs consist of hard, white crystalline limestone; the pupils are obsidian and the fragmentary rims are copper.

Birds' Eyes. In connection with the obsidian pupils of the Old Kingdom imitation human eyes, it may be mentioned that imitation birds' eyes of this period are also of obsidian. Thus the eyes of the gold head of the hawk found at the same place and probably of the same date as the Pepi statues "are formed by a single rod of obsidian polished in a spherical curve at each end. . . ."[1][2]: there are no rims. Wainwright refers to the use of obsidian for the eyes of a very large bird statue of the same place and date now in the Museum of University College, London.[3]

MIDDLE KINGDOM.

The same two kinds of eyes that were made in the Old Kingdom continued to be employed also in the Middle Kingdom, though the pupils of those of Class II were sometimes resin in place of obsidian.

Examples: *Class I*: (1) six loose eyes from Dahshûr; (2) seven loose eyes from Lisht[4]; (3) two loose eyes of which the origin is unknown; (4) the eyes from the wooden mummy mask of Auabra; (5) the eyes of the statue and statuette of King Hôr; and (6) the eyes from the coffin of Sepa from El-Barsha.

Class II: (1) the eyes from both the inner and outer coffin of Amenemhet, prince of Hermopolis; (2) nine loose eyes mostly from El-Barsha; (3) the eyes from the coffin of King Hôr; (4) eleven loose eyes from Lisht[5]; and (5) the eyes from the coffins of Senebtisi. All these eyes except the last mentioned have been examined, many of them being in the Cairo Museum.

Class I.

Loose Eyes from Dahshur. These six eyes (three pairs) are all alike; the rims are silver; the eyeballs are opaque white quartz; the cornea is transparent rock crystal; at the middle of the under side of the cornea a small circular recess has been drilled to receive the pupil, the nature of which and of the iris will now be dealt with. Vernier, who has described these eyes,[6] wrongly identifies the opaque quartz eyeball (*pierre blanche* he calls the material) as the cornea.

In one of the eyes (No. 52948) the cornea is missing and in another (No. 52949) it is loose and can be removed. These two specimens, therefore, can be studied in much greater detail than the others.

No. 52948. The cavity in the eyeball is very deep, much more so than usual, and is partly filled with dark brown resin. Vernier points out that this

[1] W. M. Flinders Petrie and J. E. Quibell, *Hierakonpolis*, I, p. 11.

[2] The writer had the good fortune to be allowed to examine this rod on one occasion when it was removed temporarily from the head.

[3] G. A. Wainwright, *op. cit.*, p. 88.

[4] Six of these eyes were kindly given to the writer by Mr. Ambrose Lansing of the Metropolitan Museum of Art, New York.

[5] These were kindly given to the writer by Mr. Ambrose Lansing.

[6] E. Vernier, "Bijoux et Orfèvreries," in *Cat. Gén. du Musée du Caire*, I, Nos. 52945, 52946, 52947, 52948, 52949, 52950, pp. 312–4.

filling is friable (*sans beaucoup de résistance*) and that it must have been introduced into the cavity in a viscous (*malléable*) condition. In the absence of the cornea, the iris and pupil are also necessarily missing.

No. 52949. The sides and bottom of the cavity in the eyeball, which is not nearly so deep as that in No. 52948, are very irregular and show how the quartz has been drilled and chipped out, the mark of a circular drill being still visible. It seems almost certain that a filling of a similar dark brown resin to that present in No. 52948 originally existed in this case also (and probably exists, too, in the other four eyes, though it cannot be seen), having been put into the cavity to hide the uneven surface of the quartz and to help to form the iris; but the only evidence of this resin that now remains is a little in the hole in the cornea and a patch adhering to the back of the cornea round the mouth of the hole.[1]

No. 52945. The iris is partly grey and partly brown. When the cornea is merely placed on the resin filling and is not in absolute contact with it, but is separated from it by a thin film of air, the appearance, as seen from the front, is grey [2] and is due almost entirely to the optical effect of the matt surface of the back of the cornea; but when the resin is in absolute and intimate contact with the cornea, as in the case of the patch already described in No. 52949, and also in one of the Class I eyes from Lisht,[3] the colour, as seen from the front, is brown: whether the original intention was a grey iris or a brown iris is uncertain. The majority of present-day Egyptians have a brown iris and it seems probable, therefore, that this was also the case anciently, hence a brown iris would be more natural; but with a brown iris the black pupil would not be very apparent, whereas with a grey iris the black pupil is very distinct, and that the pupil should be clearly seen is necessary if the general appearance of the eye is to be satisfactory. If brown were the original colour, then the cornea must have been placed in position when the resin was still in a viscous condition before it cooled and became solid, since only in this manner could absolute contact between the cornea and the resin have been produced. If this were so, then the patches of brown that now exist on several of the eyes of this class are the remains of the original condition; and the grey may be explained on the assumption that the resin has shrunk so that it no longer makes absolute contact with the cornea. If, on the other hand, the original colour of the iris were grey, then the brown patches may be explained by assuming that in some manner (possibly by heat or pressure) portions of the surface of the resin have melted and have made absolute contact with the cornea. An original brown iris appears the more likely.

The pupil, which consists of a small cylindrical projection arising from the flat surface of the iris and filling the small recess at the back of the cornea, has a black top and apparently a white circumference. Vernier explains this by saying that the whole surface of the brown resin, except the top of the projection forming the pupil, was coated with a white material, that he states was undoubtedly plaster (*i.e.*, gypsum plaster), which he thinks had decomposed and partly disappeared. Gypsum plaster, however, is a very permanent material and does not decompose and disappear, and the few white particles now to be seen in some of the small cavities in the resin may be merely tiny particles of

[1] See No. 52945.

[2] Like the iris of the eyes of the Old Kingdom wooden bust.

[3] See later.

limestone or plaster that have accidentally found their way in since the cornea was lost; no such white material can be seen in any of the other eyes. The white, however, of the circumference of the projection forming the pupil is merely an optical effect due to the manner in which the light is reflected.

No. 52946. The iris is grey; the pupil has a grey top and apparently a white circumference.

Nos. 52947 *and* 52950. In each case the iris is grey with patches of brown; the pupils are black.

Loose Eyes from Lisht. These are two pairs and three single eyes, now described.

Two Pairs of Eyes. These are identical except in size, one pair being slightly smaller than the other. There are no rims. The wedge-shaped eyeballs are alabaster, in which a circular hole has been drilled with a tubular drill; in this hole is a disc of dark brown resin, which from the manner in which it fits must have been put in while molten; on the upper surface of this resin, a little to one side of the middle, a circular spot has been painted in black to represent the pupil; on the top of the resin there is a disc of transparent rock crystal cemented in round the edges with resin; this rock crystal is flat on the under side, the surface of which is matt, as are also the edges, but slightly convex on the upper side, which is polished; there is no recess drilled at the back of the cornea; as seen through the cornea the iris is grey with brown patches in one pair of eyes and entirely grey in the other pair, the brown in one eye where the cornea has been removed for examination being due to a little resin adhering firmly to the back of the cornea, and doubtless a similar state of things accounts for the brown patch in the other eye.[1]

Single Eye. This is practically identical with the eyes from Dahshûr except that the eyeball is not opaque quartz, but alabaster, which has been drilled out with a tubular drill, the marks of which still remain; the cornea is transparent rock crystal, with a flat matt surface at the back and a slightly convex polished surface at the front; at the middle of the back of the cornea a small circular recess has been drilled for the insertion of the pupil; under the cornea which was removed for examination is a disc of dark brown resin, from the middle of the upper surface of which there is a small cylindrical projection that fits into the recess in the cornea and makes the pupil. There is no rim.

Single Eye. This is a tiny eye in a silver frame, manifestly from a statuette. The eyeball is crystalline limestone; the cornea is transparent rock crystal; the iris is grey and there is no pupil.

Single Eye.[2] This consists of a curved piece of transparent rock crystal of the "almond" shape of the conventional eye, with a small recess at the back for the pupil, which is now empty. There is no rim.

Pair of Loose Eyes of Unknown Origin.[3] These, which are of comparatively large size, are probably from a coffin. There are no rims; the eyeballs are crystalline limestone; the cornea is transparent rock crystal, between which and the bottom of the cavity in the eyeball there is a considerable space, now

[1] See No 52945.

[2] No. J.60261.

[3] Nos. $\frac{21}{25}+\frac{11}{2}$ A. and B.

empty but manifestly at one time containing some filling, the only evidence of the nature of which is a small amount of brown powder (not resin) that on analysis was found to contain organic matter; but what this material has been and whether it was the filling or an adhesive could not be determined. In the middle of the under side of the cornea a small recess had been drilled for the pupil, which is now missing. The museum register describes these eyes as of limestone and quartz.

Mask of Auabra. The rims are metal, probably copper; the eyeballs are crystalline limestone; the cornea is transparent rock crystal; what the colour of the iris was originally is not certain, but now there are dark patches on it, which Lacau calls black and suggests [1] are the remains of the adhesive that fastened the cornea in place, though this would mean a black iris, which seems improbable; there is no evidence of pupils. Lacau calls the eyeballs alabaster.[1]

Hôr's Statue. The rims of the eyes are metal, stated by de Morgan to be silver [2]; the eyeballs are either opaque quartz or crystalline limestone, though which of the two was not determined; the cornea is transparent rock crystal; and the pupil cannot clearly be seen in the poor light of the museum gallery. The finder (de Morgan) states that the eyes are made of quartz,[2] which may refer either to the eyeball or to the cornea or both. One plate in de Morgan's report [3] shows the statue with certainly the right eye missing and possibly also the left, while another plate [4] shows both eyes. At the present time there are two eyes, but the right eyeball is somewhat whiter than the left, though whether this indicates a recent addition cannot be ascertained; this right eye, however, seems almost too good a match to be modern.

Hôr's Statuette. The rims are copper; the eyeballs are crystalline limestone and the cornea transparent rock crystal; there are no pupils.

Coffin of Sepa. The eyeballs are crystalline limestone; the cornea is rock crystal with a small recess at the back filled with black material to represent the pupil; the iris is brown. Lacau calls the eyeball white alabaster, the cornea rock crystal, the pupil black and the iris brown.[5]

Class II.

Amenemhet Coffins. One of the eyes from the inner coffin is still in place, but the other is exhibited separately.[6] The one rim remaining is copper; the eyeballs are crystalline limestone and the pupils obsidian. The eyeball of the loose eye is described in the museum register as alabaster, and the pupil as basalt. Lacau states [7] that the rims are metal, the eyeballs alabaster and the iris and pupil polished black stone.

The two eyes from the outer coffin are not in position, but are exhibited

[1] P. Lacau, "Sarcophages antérieurs au nouvel empire, II," in *Cat. Gén. du Musée du Caire*, No. 28107, p. 85.

[2] J. de Morgan, *Fouilles à Dahchour, mars-juin*, 1894, p. 95.

[3] J. de Morgan, *op. cit.*, Pl. XXXIII.

[4] J. de Morgan, *op cit.*, Pl. XXXV.

[5] P. Lacau, *op. cit.*, I, No. 28084, p. 199.

[6] No. $\frac{21}{25} + \frac{11}{7}$.

[7] P. Lacau, *op. cit.*, II, No. 28091, p. 63.

separately.[1] The eyeballs are crystalline limestone; the pupils consist of plano-convex discs of limestone covered on both sides with a layer of black resin; there are no rims. In the museum register these eyes are described as made of alabaster and bitumen. Although the black material of the pupils somewhat resembles bitumen in appearance, that it is not bitumen is proved by the fact (among other properties) that it is insoluble in petroleum spirit, whereas bitumen is soluble in this solvent. Lacau states [2] that the technique of the eyes from the outer coffin is identical with that of the eyes from the inner coffin, which, however, is not so.

Loose Eyes mostly from El-Barsha.[3] *A Pair of Eyes* [4]: no rims; the eyeballs are crystalline limestone; the pupil (one is missing) is obsidian. These are described in the museum register as of limestone and basalt.

Pair of Eyes [5]: no rims; the eyeballs are crystalline limestone; the pupils are obsidian. The museum register describes the materials as very fine polished limestone and obsidian.

Pair of Eyes [6]: the rims are metal, probably copper, much corroded; the eyeballs are crystalline limestone; the pupil (one is missing) is obsidian and probably does not belong. The museum register describes the materials as copper, limestone and basalt, respectively.

Single Eye [7]: the rim is metal, probably copper; the eyeball is crystalline limestone; the pupil is obsidian. The museum register describes the materials as copper, limestone and basalt, respectively, and states that the pupil does not belong.

Single Eye [8]: no rim; the eyeball is crystalline limestone that has been accidentally stained green by a copper compound, probably from a copper rim that is now missing; the pupil is obsidian. The museum register describes the eyeball as ivory, coloured green (*ivoire verdi*). Budge states [9] that "In the case of women of quality eyes made of obsidian and ivory were inserted in the eye-sockets," and he also mentions [10] "ivory eyes for inlaying in coffins," but no confirmation of this use of ivory can be found.

Single Eye [11]: the rim is corroded metal, probably copper; the eyeball is banded alabaster; and the pupil is black resin. The museum register describes

[1] No. J.34310.

[2] P. Lacau, *op. cit.*, II, No. 28092, p. 51.

[3] See Ahmed Kamal, "Fouilles à Déïr-el-Barsheh," in *Annales du Service*, II (1901), pp. 17, 32, 212, 217.

[4] Nos. $\frac{21}{25}+\frac{11}{3}$ and $\frac{21}{25}+\frac{11.}{4}$

[5] No. $\frac{21}{25}+\frac{11.}{5}$

[6] No. $\frac{21}{25}+\frac{11.}{8}$

[7] No. $\frac{21}{25}+\frac{11.}{6}$

[8] No. J.34317.

[9] E. A. Wallis Budge, *British Museum Guide to the First, Second and Third Egyptian Rooms*, 1924, p. 17.

[10] E. A. Wallis Budge, *op. cit.*, p. 154.

[11] No. J.49474.

the rim as bronze, the eyeball as alabaster, and the pupil as resin, and states that this eye is from Abusîr el-Malaq.

Hôr's Coffin. The rims of the eyes are metal, probably copper; the eyeballs are crystalline limestone; and the pupils are obsidian. Lacau states [1] that the eyeballs are alabaster, very white and polished, and the pupils a polished matt black stone, probably obsidian.

Loose Eyes from Lisht. These eyes are all practically alike in both materials and technique; they only differ in size. There are eleven altogether, four pairs and three single ones. One of the single eyes is larger than the rest and is probably from a coffin, and another single eye that is very small is almost certainly from a statuette. The eyeballs in every instance are crystalline limestone; the pupils are obsidian, underneath which in seven cases certainly, and probably in nine, there was originally and still is in several instances a black material composed of whiting and resin coloured with carbon, which had been put in to fill the cavity below the pupil. The two exceptions are the large coffin eye and the small statuette eye: the former shows no traces of this black material, the cavity for the insertion of the pupil being merely a hole through the eyeball without any bottom; the latter has not been taken to pieces for examination. The only rim is that of the small statuette eye, which is of copper.

Coffins of Senebtisi. Mace and Winlock, describing the eyes of the three coffins of Senebtisi (XIIth dynasty) state [2] that those of the outer coffin are of "stone"; that those of the middle coffin "were made up of almost flat sheets of stone, obsidian for the pupils, and opaque calcareous stone for the whites . . . The pieces were fastened together with a blackish gum and set in tray-like wooden frames . . . the edges of which represented the eyelids"; and that those of the anthropoid coffin had "polished obsidian pupils, whites of calcareous stone and silver frames of which the edges project to represent the eyelids."

NEW KINGDOM.

All the human eyes of this period examined belong to Class II.

Examples: (1) the eyes of the coffins of Yuya (XVIIIth dynasty); (2) the eyes of the coffins of Thuyu and of the mask of Thuyu (XVIIIth dynasty); (3) the eyes of the coffins and mask of Tut-ankhamûn (XVIIIth dynasty); (4) the eyes of the canopic coffins of Tut-ankhamûn; (5) the eyes of the two large statutes of Tut-ankhamûn; (6) the eyes of the Anubis statue from the tomb of Tut-ankhamûn; (7) the eyes of numerous human, animal and bird figures from the tomb of Tut-ankhamûn; and (8) the eyes of the coffins of Queen Meryet-Amûn (XVIIIth dynasty). All the above-mentioned eyes are in the Cairo Museum and have been examined as closely as was possible.

Coffins of Yuya. There are three coffins, the eyes of all of which appear similar; namely, blue rims, white eyeballs and large black pupils. The rims are glass; the eyeballs of both the innermost coffin and the middle coffin alone have been examined, those of the former being opaque white quartz and those of the latter crystalline limestone; the pupils of both coffins are almost certainly obsidian and not black glass (the alternative), though this cannot be proved

[1] P. Lacau, *op. cit.*, II, No. 28100, p. 77.

[2] A. C. Mace and H. E. Winlock, *The Tomb of Senebtisi at Lisht*, pp. 23, 30, 40.

without damaging the eyes. Quibell states [1] that the rims are blue glass, the eyeballs marble, and the pupils black glass.

Coffins and Mask of Thuyu. There are two coffins, the eyes of both of which have been examined. The rims are blue glass; the eyeballs are crystalline limestone; and the pupils almost certainly obsidian. The eyes of the mask are similar to those of the coffins, the eyeballs being crystalline limestone, and the pupils almost certainly obsidian. Quibell says of all these eyes that the rims are blue glass, the eyeballs white marble, and the pupils black glass.[2] With reference to the mask he states [2] that "a curious point is that there is a green faience backing to the white of the eye, invisible outside, inside nearly filling the space inside the blue glass." This the writer has not been able to examine.

Coffins and Mask of Tut-ankhamûn. The appearance of the eyes in all three coffins and mask are the same; namely, blue rims, white eyeballs and large black pupils. The rims of the coffin-eyes are dark blue glass, but those of the eyes of the mask are lapis lazuli. When the innermost (gold) coffin was first seen the eyeballs of the eyes were so badly decomposed that they fell to pieces when the coffin was moved, probably having been acted upon by the volatile acids derived from the fatty matter forming part of the black anointing material that had been poured over the coffin, though not over the face. These eyeballs were probably of crystalline limestone and the pupils (which were unacted upon) are almost certainly obsidian. The eyeballs of the other two coffins and of the mask have not been tested, but they are also probably crystalline limestone and the pupils almost certainly obsidian. Carter states in one place [3] that the eyeballs of the outermost coffin are aragonite and in another place [4] that they are calcite and that the pupils are obsidian.

Canopic Coffins of Tut-ankhamûn. The rims round the eyes are blue glass; the eyeballs of the eyes of three of the coffins are probably crystalline limestone (in the fourth coffin the eyes are missing); and the pupils are almost certainly obsidian.

Large Statues of Tut-ankhamûn. The eyes consist of white eyeballs, which have not been tested, but which are probably crystalline limestone, and large black pupils which are almost certainly obsidian. The rims are gold.

Anubis Statue from the Tomb of Tut-ankhamûn. The rims are gold; the eyeballs which have not been tested are probably crystalline limestone; and the large black pupils are almost certainly obsidian. Carter states [5] that the eyes "are inlaid with gold, calcite and obsidian."

Human, Animal and Bird Figures from the Tomb of Tut-ankhamûn. The eyes of a number of these figures have been examined with the following results:

Human Figures. In the eyes of six human statuettes the eyeballs are crystalline limestone and the pupils almost certainly obsidian. In the other instances not examined, the technique is similar and probably the materials are also similar. Of some of these statuettes Carter states [6] that "their eyes

[1] J. E. Quibell, "Tomb of Yuaa and Thuiu," in *Cat. Gén. du Musée du Caire*, Nos. 51002, 51003, 51004, 51006, 51007, 51009; pp. 4, 5, 10, 20, 23, 28.

[2] J. E. Quibell, *op. cit.*, p. 28.

[3] Howard Carter, *The Tomb of Tut-ankh-Amen*, II, p. 52.

[4] Howard Carter, *op. cit.*, II, p. 247.

[5] Howard Carter, *op. cit.*, III, p. 41.

[6] Howard Carter, *op. cit.*, III, p 52.

are inlaid with obsidian, calcite, bronze and glass." The bronze has reference to the metal rims, which have not been tested and which may be copper, and the glass possibly to the black or blue glass of the eyebrows.

Cow Head. The rims of the eyes are black glass ; the eyeballs are crystalline limestone ; and the pupils are almost certainly obsidian. Carter refers[1] to the " inlaid eyes of lapis lazuli glass."

Cobra. The cornea of the eyes of a large gilt wooden figure of a cobra consists either of glass or rock crystal, but probably glass, underneath which the black pupil is painted, while the yellow iris is probably gold leaf.

Lions' Heads on Throne. The technique and the materials of the eyes are similar to those of the eyes of the cobra, except that a small amount of white eyeball is shown, that is probably painted.

Birds' Eyes. Those that have been examined are almost certainly obsidian and probably the others also.

Coffins of Meryet-Amûn. Winlock describes[2] the eyes on both the first and second coffins of Queen Meryet-Amûn as having eyeballs of alabaster and pupils of obsidian, which they appear to be.

LATE EGYPTIAN PERIOD.

All the human eyes of this period examined belong to Class II. According to Elliot Smith and Warren Dawson[3] the practice of inserting artificial eyes into the eye-sockets of mummies " was already coming into vogue in the XXth dynasty," and Elliot Smith gives a number of examples ; thus he says of the mummy of Queen Notmît (XXIst dynasty) :[4] " Artificial eyes, made of white and black stone, were inserted under the eyelids. This is the earliest instance of the use of stone eyes or of the attempt to represent the pupil in an artificial eye in a mummy, although in statues such objects had been in use more than fifteen centuries." Other examples of inlaid eyes given are those of Queen Mâkerî (XXIst dynasty) and of five other mummies of the period XXIst to XXIInd dynasty.[5]

Three eyes of the period XXIIIrd to XXVth dynasty from Abusîr el-Malaq have been examined,[6] but whether these are from a mummy, a statue or a coffin is not known. The eyeballs are banded alabaster (calcite) ; the one pupil remaining (two being missing) is dark brown resin fastened to the flattened front of the eyeball ; the frames are metal, either copper or bronze.

GREEK AND ROMAN PERIODS.

All the eyes of these periods examined are of Class II type, glass, however, being generally used instead of the crystalline limestone and obsidian of the earlier Class II eyes.

The Graeco-Egyptian coffin masks in the Cairo Museum have been described

[1] Howard Carter, *op. cit.*, III, p. 46.

[2] H. E. Winlock, *The Tomb of Queen Meryet-Amûn at Thebes*, pp. 18, 20.

[3] G. Elliot Smith and W. R. Dawson, *Egyptian Mummies*, p. 113.

[4] G. Elliot Smith, " The Royal Mummies," in *Cat. Gén. du Musée du Caire*, p. 96.

[5] G. Elliot Smith, *op. cit.*, pp. 99, 103, 105, 108–9, 111, 114.

[6] From the Cairo Museum ; not numbered.

by Edgar, who says [1] of the eyes on the first century masks that they are "usually painted" and, if inlaid, they are made of "opaque material, stone or glass," and he adds [1]: "So far as I have had them examined and tested, they seem usually, if not always, of glass." He also says [1]: "But on the heads of the present class the eye is usually inlaid in a different way: a small convex sheet of transparent glass or mica is laid over a plaster ground on which the iris is painted in black." With respect to the mica, Edgar states [1] that "On some of the specimens which I have seen the material looked like mica, but in most cases it seems to be artificial glass, sometimes iridescent and sometimes full of small air-bubbles." The present writer, who has examined all these masks, cannot find any on which the material is mica. Describing other masks, Edgar states [2] that "the eyes are here inlaid in transparent glass. Judging from examples in the Cairo collection, it seems to have been in the second quarter of the IInd century that this technique came into use." The results of the writer's examination of these mummy masks may briefly be summed up as follows: in addition to the eyes that are entirely painted, there are many in which the iris is painted in black and the whole eye covered with a thin piece of curved transparent glass, which is now sometimes iridescent owing to surface decay; there are many others that are fully inlaid, the rim being generally glass, often blue, but occasionally black, the eyeball white opaque glass, and the iris black opaque glass.

Petrie writes [3] that "The eyes are . . . more usually inlaid, and with copper foil fringes for the eyelashes." Of the eyes of certain Ptolemaic mummies in box coffins he says [3]: "They were made by bending and cutting a piece of opaque white sheet glass to the form, inserting a disc of black glass for the iris, and surrounding it with a neatly curved border of blue glass, always polished on the upper surface. . . ." He points out that [3] "The gilt busts of more substantial form, about 50 A.D., required more solid work; and the eyes are then cut in white marble, tapering wedge-shaped behind, and with a hole drilled in the middle to receive an iris plug of black glass or obsidian. The finest portrait busts demanded higher work, and then the iris was of clear brown glass or stone, with a pupil of black glass inserted. . . "

The writer has recently examined eight pairs of eyes and eight single eyes from Roman mummy masks found at Sûnûfar in the Fayûm province.[4] Nineteen of these eyes (seven pairs and five single ones) are practically alike in essentials, though differing in some instances in such details as shape and size. The eyeballs are crystalline limestone, that were surrounded originally by copper rims, which in most cases are now fragmentary or missing, but which in one instance are cut on the outer edges to simulate eyelashes. In one case the material used to fasten the eyeball into the socket remained, and on analysis proved to be gypsum plaster. The eyeballs are all more or less wedge-shaped and measure from back to front from 1·5 to 2·3 centimetres, the deeper ones being true wedges tapering almost to a point behind, and the shallower ones having a flat surface at the

[1] C. C. Edgar, "Graeco-Egyptian Coffin Masks," in *Cat. Gén. du Musée du Caire*, p. vi.

[2] C. C. Edgar, *op. cit.*, p. viii.

[3] W. M. Flinders Petrie, *Hawara, Biahmu and Arsinoe*, p. 17.

[4] Three pairs and two single eyes are now exhibited in the Cairo Museum, Nos. J.63027–63031. Kindly submitted by Mr. O. Guéraud.

back. In the middle of the front of the eyeball there is a circular depression in which are inlaid the iris and pupil,[1] the iris consisting of black glass in the shape of a ring having an outer diameter of from 10 to 15 millimetres, with a circular hole in the middle from 3 to 6 millimetres in diameter, which is filled with a small cone-shaped plug of black glass to form the pupil.[2] Between the pupil and iris there is generally, though not always, a very thin piece of copper foil, so thin that it hardly shows at the surface. The glass of both the iris and pupil in all cases shows evidence of decomposition, generally, however, only on the surface.[3]

One pair of these eyes consists of thin, slightly concavo-convex eye-shaped pieces of bone, having in the middle of the front, instead of the usual cavity, a flattened circular area to which the pupil (now missing) had been fastened.

One single eye consists of an outer framework of dark blue glass; a thin slightly curved piece of opaque white glass flattened somewhat in the middle of the convex side to represent the eyeball, and a thin piece of glass, now white and much decayed, but probably originally black, that fitted on to the flattened surface of the eyeball to represent the pupil.

In one case an iris of black glass with a plug of black glass for the pupil are all that remain of an eye, and in another instance only the cone-shaped pupil of black glass is left.

UNDATED BUT MOSTLY LATE.

Twenty-six loose eyes (six pairs and fourteen single eyes), many of which are in the Cairo Museum, have also been examined; all of them, unfortunately, are undated. They are as follows:

Pair of Coffin Eyes.[4] The eyeballs are crystalline limestone and the pupils almost certainly obsidian.

Two Pairs of Huge Eyes. One pair[5] consists merely of the metal frames (copper or bronze) and white limestone eyeballs, the pupils being missing. The frames are about 27 cm. (about 11 inches) long. Another similar pair (no number), also without pupils, are 23 cm. (9 inches) long.

Pair of Eyes.[6] The rims are blue glass; the eyeballs are white opaque glass; and the pupils black glass; the rim, eyeball and pupil of each eye are fused together intentionally.

Pair of Eyes.[7] The rim (one is missing) is blue glass; the eyeballs are missing; the pupils are obsidian or black glass, but probably obsidian.

[1] Both iris and pupil are missing in one eye.

[2] In one instance the pupil is very dark blue glass, so dark as to appear black by reflected light.

[3] In two cases the iris is partly light-green and partly black, and in a third case wholly light-green; but all three have probably been black originally, the black having decomposed and become green

[4] No. $\frac{26}{25}+\frac{3}{3}$

[5] Nos. $\frac{20}{24}+\frac{11}{15}$ and $\frac{20}{24}+\frac{11.}{16}$

[6] No. [illegible]

[7] Nos. $\frac{22}{26}+\frac{12}{12}$ and $\frac{22}{26}+\frac{12.}{13}$

Pair of Eyes.[1] The eyeballs are broken and partly missing, one consists of crystalline limestone and the other probably of magnesite or magnesian limestone; the pupils are obsidian or black glass, but probably obsidian.

Single Eye.[2] The rim is blue glass; the eyeball is white opaque glass; and the pupil black glass.

Single Eye.[3] The eyeball is white opaque glass; the pupil black glass; and the rim blue glass, now corroded and green on the outside.

Single Eye.[4] The rim, eyeball and pupil are all one piece of faience, the rim and eyeball being coated with blue vitreous glaze and the pupil with a black glaze, which is now slightly corroded on the surface.

Single Eye.[5] The rim is a fine-grained, soft stone, black and polished on the outside and dark grey inside, which is neither limestone nor gypsum, but almost certainly dark grey steatite, the surface blackening being probably due neither to paint nor dye, but merely to the effect of the polishing; the eyeball is white opaque glass; and the pupil black glass. The eyeball is fastened to the frame (rim) by means of black resin, which is also used to fasten in the pupil.

Single Eye.[6] This consists of cornea and pupil only, the cornea being transparent rock crystal with a small recess drilled in the middle of the under side, which is filled with dark brown resin.

Two Single Eyes.[7] These, which are slightly smaller than the usual eye and of different sizes, are of the normal Class II type, without rims; the eyeballs are crystalline limestone; and the pupils obsidian.

Single Eye.[7] This is the eyeball alone, which is of crystalline limestone; in the middle of the front a shallow circular depression for the pupil (which is now missing) has a layer of dark brown resin at the bottom.

Single Eye.[7] This is the framework and back of an eye only, in the form of a shallow eye-shaped tray with raised border that had been cut in one piece out of limestone and blackened artificially on the surface.

Three Single Eyes.[7] These three eyes are of slightly different sizes, but similar technique, each consisting of a framework with a raised border, somewhat like the previous specimen; the "tray," however, is not so deep and the bottom of the tray represents the eyeball, in the middle of which is a raised oval-shaped pupil with a convex upper surface. The whole (frame, eyeball and pupil) is one piece of limestone, the entire surface of which has been blackened artificially.

[1] Nos. $\frac{22}{26}+\frac{12}{14}$ and $\frac{22}{26}+\frac{12.}{15}$

[2] No. $\frac{21}{26}+\frac{12.}{16}$

[3] No. J.36218.

[4] No. $\frac{21}{26}+\frac{12.}{17}$

[5] No. $\frac{11}{34}+\frac{5.}{1}$

[6] Submitted by Mr. C. C. Edgar; no number.

[7] In the Cairo Museum store; no numbers.

Single Eye.[1] Fragment of large eye consisting of an oval pupil (approx. 7 × 8 cm.) and part of the lower rim, both one piece of faience, the pupil being glazed black and the rim blue.

Single Eye.[2] This is the frame only, which is of silver, solid and well made and in excellent preservation; after the removal of a thin film of surface discoloration it is as bright and polished as when made. Probably from Beni Hasan.

ARTIFICIAL EYES IN MESOPOTAMIA.

In connection with the artificial eyes from Egypt, the artificial eyes of statues and statuettes from Mesopotamia should be mentioned.

The technique of artificial eye-making in Mesopotamia was much inferior to that of Egypt, none of the Mesopotamian eyes being nearly so good as the Egyptian eyes of Class I; they all correspond more nearly with the much poorer Egyptian eyes of Class II, though made of different materials. In the Mesopotamian eyes only the eyeball and pupil are represented, neither the cornea nor iris being shown. The eyeball is made of white shell [3] and the pupil of bitumen, black limestone or lapis lazuli.[4]

The Mesopotamian eye-maker did not use the transparent rock crystal that gives such a life-like appearance to the better class of Egyptian eyes—possibly because he did not know it, whereas it occurs naturally in Egypt and was employed for small vases and other objects from a very early date. Obsidian, too, which was largely used in Egypt for the pupils of human eyes and for the entire eye of birds, though known in Mesopotamia, was not employed for eye-making, its place being taken by bitumen, which though considerably the easier of the two to work has a dull, dead appearance compared with bright, polished obsidian. Resin, also, which was sometimes employed in Egypt for the pupil of the eye, also under the cornea to give colour to the iris, and as a cementing material to fasten the various parts of the eye in place, was not used for any of these purposes in Mesopotamia, bitumen being employed instead. Glass, so frequent in Egypt in eyes of Graeco-Roman date, was not used at all for eyes, so far as is known, in Mesopotamia.

A. Lucas.

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[1] No. $\frac{31}{26}+\frac{12.}{8}$ [2] No. $\frac{4}{25}+\frac{8.}{6}$

[3] One instance of the use of "yellow paste" is known.

[4] H. Frankfort, "A Great Discovery of Sumerian Sculpture," *The Illustrated London News*, May 19th, 1934, pp. 761, 774–8, 802.

Artificial Eye in Petrie Collection, University College, London.
(3·25 cms. long.)

Mr. Lucas is evidently not aware of a glass eye, now in the Petrie Collection at University College. This eye has a border of blue (probably cobalt by the

colour) and the iris is black. The shape and size of the eye, as well as the fact that the edges are carefully rounded, show that it was for human use. Eyes for insertion in statues and coffins have sharp edges totally unlike this example. It is not surprising that Mr. Lucas should not have known of this eye as it has never been published and is too insignificant in size and appearance to attract attention in a museum case. M. A. M.

A TEMPLE SEAL AND ITS CONNECTIONS.

The bronze seal illustrated in fig. 1 is shown by the inscription on the base—*pr. Imn*—to have been used in the temple of Ammon, probably at Thebes; the figure seated within the sloping bars of the handle is that of the god himself, with his characteristic head-dress. The exact provenance of the seal is not known; it came into the hands of a Cairo dealer together with several fragments of similar seals. Its height is $2\frac{1}{4}''$ and the base is not quite $1\frac{1}{4}''$ square; the god's face and head-dress have been rubbed down by much handling and the ring for suspension is worn thin. (Cf. fig. 178, pl. LX, of *Objects of Daily Use*, also the seal, without a number, above it.) To propose a fixed date would be

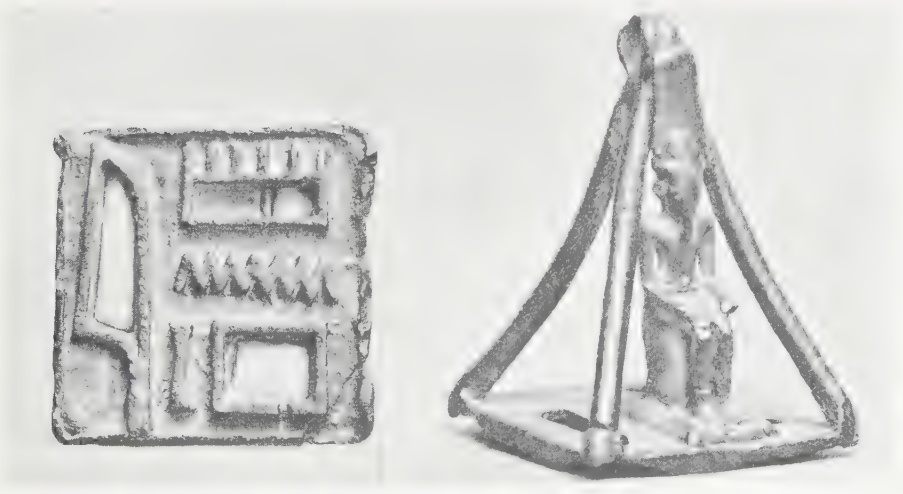

FIG. 1. (1 1)

hazardous, but it might well belong to the XIXth dynasty. It doubtless served to seal up the doors of a shrine or receptacle for objects of sacred use, in the manner illustrated by Dr. Howard Carter in *The Tomb of Tut . ankh . amen*, vol. II, pl. LX; a cord was tied round two staples, one on the door and the other on the frame, a dab of damp clay on the cord was then impressed with the seal to act as a safeguard against unauthorised opening of the door. It will be remembered that the daily ritual of worship at the sacred shrines, of which M. Alex. Moret has given an account in *Le Rituel du Culte Divin journalier*, began with the ceremonial breaking by the priest of the protecting seals before he opened the door and proceeded to the rites connected with the divine image.

Protection by a mere lump of clay would seem weak and, of course, was so for a determined thief or desecrator, but against less bold spirits it was ample, for the clay impression was charged with the dangerous power accompanying a holy name, and whoever broke it incurred the sacred wrath—he broke, in fact, a terribly strong *tabu*, and none but a hardened malefactor would risk the consequences of such an act.[1]

The use of seals apparently came from the racial element, whatever it was, which gave to the ancient Egyptian language its Semitic complexion, for the word *khetm*, commonly used in the Old Kingdom, is purely Semitic; moreover, the first form of seal used in Egypt appears to have been the cylinder which was current in Semitic countries, for the hieroglyph denoting a seal consisted of a picture of a cylinder with the loop of string to which it was attached. The foreign form gave way before the end of the Old Kingdom to the handier stamp-seal and only survived as an amulet, whereas in Mesopotamia its original use was maintained till the end of the Persian rule, affording, no doubt, another illustration of the maxim that the country in which any artefacts or practices most vigorously survive is usually that in which they originated.[2]

The relegation of the cylinder to mere amuletic use introduced no new principle, for it had always been endued with an inherent talismanic quality; the first Egyptian examples, about the beginning of the Dynastic period, served evidently as amulets, usually of a funerary nature; in some cases several have been found together, bearing the same name but with varied funerary inscriptions—they certainly could not have been made for seals. Even in commercial Mesopotamia the seal always retained its religious character, sanctified with the names of great divinities; the sacred theme was an essential component and the first, at least in some instances, to be engraved on the stone, as we may see from specimens which had been prepared for sale, but left unfinished, with blanks to be filled with the purchasers' names.[3] This character was maintained till the coming of the Persians, a conquering people of Aryan speech and more rationalistic in thought, who mostly banished religious themes from their amulets, substituting scenes of war and the chase.

An examination of the development of the engraved cylinder from its earliest appearance gives good reason to conclude that in its first origins it was purely amuletic. The earliest examples, from Kish and elsewhere in Mesopotamia, bore no names; they were probably developed from the long cylindrical beads, so common at that period, which themselves had doubtless, like most or all early beads, an amuletic as well as a decorative value. They were often made of costly stones such as carnelian, and especially of that very precious mineral lapis lazuli, brought from the distant mountains of Badakshan (now north-west Afghanistan). Another material, sea-shell, was much used; it appears in the

very earliest times and was perhaps the first of all materials shaped into cylinders for, besides being easy to cut, it had gained even in Palaeolithic times the amuletic and decorative values that we find in beads. It may be suggested that the further development from cylinder to seal was as follows: to make the amulet more personal and therefore more efficacious for its owner, his name would be added to it, and it would soon be found that the bead thus engraved could serve as a seal to give the clay documents to which it was applied a voucher of authenticity, or to effect, easily and quickly, a sacred *tabu*. If this view be correct it follows that the theory which places the origin of the cylinder seal in the joint of a reed is untenable and that the use of wood and reeds, of which traces have been found in Egypt, was a later development for common use.[4]

After the Old Kingdom the cylinder, as a talisman, yielded in popularity to the so-called "button-seal," which would be more rightly named the "button-amulet." These objects first appear in considerable quantities in the First Intermediate Period, following the breaking up of the Old Kingdom. They have been found early outside Egypt, and it has been suggested that they were importations from abroad, at first rare, introduced by the people who were then invading Lower Egypt. But Mr. Guy Brunton's recent excavations at Qau have proved that they were mere amulets, usually attached to the person by a string passing through the loop at the back, that they were in common use, of local make, and engraved with local subjects (Sir Flinders Petrie, in fact, had noted the last point in *Buttons and Design Scarabs*, p. 4, par. 6). It is hardly surprising that they should first have been considered as foreign, so new are many of the types. The very violent revolution that ended the Old Kingdom must have given the classes below the rank of courtiers a freedom never before touched and made possible for them the enjoyment of things previously unattainable, as Brunton's grave-finds attest (see his remarks in *Qau and Badari*, I, p. 75, par. 184). Amulets were now used in countless numbers and of many kinds; the "button" variety, which is found sparsely at the end of the Old Kingdom, became common and displayed many kinds of design, mostly of familiar type and sometimes clumsily copying scraps of inscriptions on sacred buildings, while occasionally, as stated above, they show a quite new character largely unintelligible to us. But they were all indigenous, for the intelligible ones display Hathor symbols, *ᶜonkh*, lions, and so on; they thus had a magico-religious character which there is little doubt was shared also by those that we cannot understand, which may represent religious ideas of a popular kind that did not filter through into the official cult.[5]

The loop at the back of the button-amulets was also often pressed into amuletic service, being fashioned into a small carved figure, sometimes in the round.[6] Among these figures was the *scarabaeus* beetle, which had long enjoyed a degree of sacredness derived in all probability, in spite of the very late Greek ratiocinations, from its name, *kheper . r*, which connected it with an essential form of the Sun-god as Lord of Being or of Forms (*khepri*—he is even represented as a beetle under this name in MSS. of the New Empire).[7] This sacredness soon ensured for the scarab form of amulet-seal a great predominance over the other forms, and it may be argued that here we have the origin of the scarab amulet of the conventional type which was made in vast quantities from the Middle Kingdom till the Saitic period and, uninscribed, through the Ptolemaic period.[8] It spread, like other elements of Egyptian influence, to foreign countries in the Eastern Mediterranean area and was largely manufactured by the Phoenicians.[9]

In the Middle Kingdom the practice began of inscribing owners' names

on the bases of scarab amulets, as part, perhaps, of the general return, with more settled times, to ancient ways: before this period inscribed cylinders were employed, but scarabs were now the fashion and the cylinder was mostly discarded.

At this time, too, the names of kings were frequently engraved on the bases of the scarabs, for kings were gods and their names were endowed in popular imagination with strong and active virtues. It would seem, too, that scarabs gained in amuletic power in proportion to the greatness of the king whose name they bore, a principle that may account for the extraordinary numbers that have been found engraved with the name of Thothmes III, the Napoleon of ancient Egypt. It must be borne in mind, however, that the vast majority of scarabs, like other amulets, bear no names of persons, royal or otherwise.

The theory outlined above may be thought to be weakened by the fact that a few rare scarabs of the conventional type have been found inscribed with names of kings who reigned before the appearance—as far as we now know—of button-amulets. Different views are current about such scarabs, some holding them to be contemporaneous with the kings whose names they bear, while others consider them of later make, mainly archaisations of the Saitic period when the fashion was all for ancient things.[10] That the worship of older kings is known, in at least some cases, to have survived to later times, supports the latter view, a well-known instance being that of Amenhotep I, who was revered as protector of the Theban necropolis. Sir Flinders Petrie, in *Ancient Egypt* (1917, part IV, p. 170), has pointed out that there were found at Gurob many stelae of adoration of Thothmes III that were made in the much later period of Rameses II. The stela in pl. XXIV, 11, of *Illahun, Kahun and Gurob*, erected for a Royal Scribe, Rè.mes.m.per.Amûn, may be quoted, although Sir Flinders, in this earlier publication, thought it to be of the XVIIIth dynasty (*Op. cit.*, p. 20, end of par. 40). It should be noted that the king is entitled "the Good God, Lord of the Two Lands," the title used only for living kings, dead ones being called "the Great God." Again, Barsanti in *Ann. du Serv.*, vol. XIII, p. 255, described a stela of the XIXth dynasty inscribed with an adoration of King Teti, one of several from his pyramid.[11] A case of special interest is that of King Shepseskaf (IVth dynasty), whose cult was suppressed, perhaps because he was unorthodox in respect to the Solar cult which reigned supreme in the next dynasty; it was revived, however, in the XIIth dynasty by a butcher's family, who seem to have found it a source of profit.[12] On the other hand, if material evidence were produced that the scarabs in question were contemporaneous with the kings whose names they bear, the theory suggested here would fall to the ground, unless button-amulets of the same or earlier periods were to come to light. But this material evidence would require the discovery of tombs of the Vth or earlier dynasties containing some of their original grave-goods, and for this we can hardly hope. In any case the scarab must have had some definite origin and development which it is difficult to imagine except in some such way as here outlined.

On the whole, present evidence may be taken to justify the tentative conclusion that scarab amulets were evolved from an earlier form, the button-amulet; the latter arose in Egypt at the end of the Old Kingdom, their backs were adorned with various carved figures of magico-religious significance, including the scarab-beetle; the latter, on account of its high sacred connections, gained pre-eminence over the rest; the other forms disappeared but not without

leaving a numerous progeny, for the amulets of the New Empire and later are often developments from the button form.

The amuletic origin of the scarab is well explained by Sir Flinders Petrie in *Scarabs and Cylinders with Names*, chap. 1, par. 7. Though in *Scarabs* Dr. Hall begins with emphasising their use as seals, he says later (p. 5): "Scarabs could be used as seals, of course, and were so used, but primarily all were amulets." As Sir Flinders has pointed out from actual remains, their use as seals was exceedingly limited—occasional, not regular. A good collection of XIIth dynasty sealings from scarabs is to be seen in pl. IX of *Illahun, Kahun and Gurob*; they are mostly without names and clearly amuletic in character, although at this period scarabs inscribed with names are far more common, proportionately, than in later times. The so-called seals discovered at Mohenjo-daro and Harappa in India are in the same position as scarabs; Mr. Ernest Mackay, discussing them in the publication of those sites (pp. 379–382), comes to the conclusion that they are in fact amulets, but commonly used as seals: Sir Flinders Petrie, however, interprets them as belonging to certain offices (*Ancient Egypt*, June, 1932) and not to individuals, comparing them in this respect to some Egyptian seals of the Protodynastic period.

FIG. 2. (1/1)

That early Mesopotamian cylinders were of the same nature as scarabs is clearly shown by the pre-Sargonic grave-finds at Kish recorded by Mr. Mackay in his *Report on Cemetery "A"* (Chicago, 1925; p. 28). Some were much worn, none bore names, the subjects engraved on them were men and animals, often lions seizing prey; all were mythological; the animals were frequently presented in files, as on early Egyptian cylinders and other objects, and could have had no meaning as seals.[13] The material was mostly shell which, as we have seen, had very early gained an amuletic value in addition to its attractiveness for decoration—virtues which belonged also to the other materials, carnelian and lapis lazuli, but in a higher degree on account of their greater rarity and superior qualities. Lastly, the early cylinders were worn on a string round the neck; like Indian specimens, they were often too thin to have served as seals just as, similarly, the scarabs and button-amulets were of too awkward a shape for handling to have been intended for sealing. From all these circumstances we

may infer beyond reasonable doubt the original talismanic nature of the objects under discussion. This conclusion is further fortified by other examples of both cylinders and stamp-seals in the Near East, such as the Hittite seals, published by D. G. Hogarth, the Elamite, of both the early Susian periods, published in the *Mém. Dél. Perse*, the public collections in Paris, published by Delaporte, and many others. From these a few specimens of outstanding significance may be culled: the cylinder illustrated in Pl. 6, no. 22, of the *Guide* to the Louvre collection is shown by the inscription to have been a charm against illness; another in the British Museum was dedicated by Killula the *guzalû*, to the god Meslamtaea for the preservation of King Dungi of the IIIrd dynasty of Ur (L. W. King, *History of Sumer and Akkad*, p. 284, and illustration opposite p. 246). On the hemispherical seal of chalcedony (fig. 2), of a type common from the Assyro-Babylonian period to the Sasanian, the head of Christ is engraved, encircled with a halo and with a cross in the field on each side; underneath are cut, in Semitic characters, the letters *SM*, signifying "The (Holy) Name"; it has replaced the religious subjects of the usual Mesopotamian seals, which in the later times often consisted of scenes of priests officiating at altars of various deities; like them, it could only have served as an amulet for its owner. (It was procured many years ago from a Turkish pilgrim from North Syria on his way through Egypt to Mecca.) In this connection we may recall that while the earliest Mesopotamian cylinders bear no names and are simply amuletic, the field in the later Babylonian specimens, which bear personal names, is occupied with religious scenes, often taken, as it is now beginning to appear, from the ritual ceremony of the New Year; this ceremony was held to be of vital importance for the prosperity of the nation, the king's power also being considered incomplete if he did not take part in it from year to year. It is therefore clear that the amuletic virtue originally attributed to engraved cylinders was now represented, on a higher plane, by pictures connected with the activities of the great national gods.

FIG. 3. (1/1)

Fig. 3 shows a cylinder-amulet which represents a Bes-like creature of an exaggerated type, like the Phoenician, and on each side of him a figure performing acrobatic feats much like the dancing girls in some of the old tomb-scenes of Egypt. It was procured in Cairo and is now in the Ashmolean Museum (No. 1921–1199). The collection of oriental cylinders and seals in the Bibliothèque Nationale of Paris contains a cylinder of unknown provenance exhibiting the same acrobatic figure (Delaporte; *Catalogue*, No. 515); next to it is a Bes-like figure holding a baboon by its paw and round it are other figures, such as a bee and the twin ox-protome, of a style pointing to the late Predynastic period of Egypt, to which, accordingly, the Ashmolean example may be attributed.[14] Such cylinders can never have served as personal seals. Lastly, a specimen of glazed frit-ware published in *The British Museum Quarterly* (vol. VII, part 1, p. 6), represents the mating of cattle and served doubtless as an amulet to procure

fertility; it was certainly never a personal seal. It is perhaps a forerunner of the similar figures moulded in sugar which used to grace the stalls at fairs ("moolids") in modern Egypt.

The idea underlying the use of the temple seal is seen to be at the base of the various seal-like amulets which have come under discussion, and the interpretation of both alike throws valuable light on the early workings of the human mind as displayed in the matter of *tabus* and names or words of power. The illustration is carried further by the fact that in the Later Period the stamp-seal, on account of its sacred connections, was made to serve as an amulet, miniature models being made of it in glazed frit-ware[15]; a special form, used in the necropolis and engraved with a jackal couchant and nine captives,[16] was likewise copied in frit and used as a charm. Thus the sacred seal became, like many another thing of holiness—and not in the ancient Near East only—a mere amulet within the reach of any purchaser.[17]

Notes.

1. The power of the *tabu* among peoples of backward culture is, to the more advanced, amazing; in the Pacific Islands a twig or leaf tied ceremonially to a house, tree or other object will have all the effect of the holy name in the more advanced community of ancient Egypt. Captain James Cook found that the setting up of *tabu*-marks, such as wands, gave more protection for his purposes than even the dreaded fire-arms of his mariners. In Timor "a palm-branch stuck across an open door showing that the house is tabooed is a far more effectual guard against robbery than any amount of locks and bars" (A. R. Wallace, "The Malay Archipelago," from Hastings's *Enc. of Religion and Ethics*, vol. XII, p. 182, par. 6).

In ancient Egypt, however, the great riches laid up in the tombs of the mighty subdued the fear of the sacred seal, and robberies were always rife, compelling the authorities to post guards in the cemeteries. Similarly, in modern China when, about the end of last century the driving of railways through ancient tomb-mounds produced none of the evil results that were feared from outraged spirits of the dead, the rifling of the tombs spread rapidly—to the great enrichment of European art-collections.

2. It may be noted that the people of Mesopotamia were keen traders from the beginning of their history and probably the first to use seals for commercial purposes. In non-trading communities their use must have been very restricted, for few men outside religious and administrative circles would have need of them.

3. For one example, see the *J. of Eg. Arch.*, vol. VIII, pl. XXIII, no. 4 and p. 209 (Sidney Smith).

4. The suggestion has been made that the cylinder-amulet may have been derived from the cylindrical envelope which protected little rolls of papyrus inscribed with texts as amulets to hand round the neck, a prototype of Jewish phylacteries; the owner's name may have been inscribed on such envelopes—but no example has been found. The suggestion made in the text is to be taken as a probable deduction, fitting in with known psychological elements.

5. Besides the reference in the text to Sir Flinders Petrie's note on button amulets—written, it should be observed, before Mr. Brunton's discoveries shed so much new light on the matter—the latter's *Qau and Badari*, I, ch. xx; II,

ch. xxx, adds considerably to our knowledge of the use and meaning of these charms. For example, we may note (vol. I, p. 74, par. 181) the much greater use of them by women than by men, doubtless owing to the supposed greater liability of women to dangerous attacks from the mysterious powers of nature, an idea still current among peoples of backward culture.

6. For figures in the round see *Sedment II*, pl. LVIII, no. 1, a figure formerly supposed to represent a scribe but now recognised as the mother-goddess (Hathor, perhaps, or Isis) nursing a child; also *Qau and Badari*, I, pl. XXXIII, nos. 109–129, fig. 111, of copper, representing a monkey, is specially interesting and may be compared with the charming little human figures in copper (or bronze) published by Mr. Glanville in the *J. of Eg. Arch.*, vol. XVII (May, 1931), pl. XII and pp. 98ff, which are late and unusual developments from the earlier class.

7. The oldest object of beetle-shape so far known seems to be an alabaster case dating from the end of the Predynastic period; Petrie, Wainwright and Gardiner, *Tarkhan*, I, p. 22; pls. III, 4; XIV, 9.

8. The earlier specimens of the conventional type of scarab are shown in the plate above referred to in Mr. Brunton's work, nos. 130ff.

9. See Dr. H. R. Hall's pamphlet, *Scarabs* (published by the British Museum), p. 13.

10. See, for the former view, Sir Flinders Petrie in chap. VII of *Scarabs and Cylinders with Names*, and for the latter, Dr. H. R. Hall, *Scarabs*, p. 12, ff.

11. See *J. of Eg. Arch.*, vol. III, p. 263.

12. See *J. of Eg. Arch.*, vol. XII, p. 290.

13. See G. Bénédite in *Monuments et Mémoires; Fondation Piot*, t. 22, pp. 1, ff, and J. Capart, *Débuts de l'Art en Egypte*, 1st ed., p. 145, fig. 104.

14. The figures of dancing girls on these early amulets might favour the theory that dancing, such as that represented in tombs of the Old Kingdom, had a religious complexion. See the *Bulletin of the Metropolitan Museum of New York* on the Egyptian expeditions of 1925–7, and *Ancient Egypt*, 1928, p. 59.

15. Rough examples appear in Sir Flinders Petrie's *Amulets*, pl. VI, no. 79, and in *Objects of Daily Use*, pl. LX, nos. 174-5. Other specimens are modelled with all the structural features of the pyramidal form shown in our illustration.

16. See Dr. Howard Carter, *The Tomb of Tut . ankh . amen*, vol. I, pl. XIV, no. 3.

17. The vast numbers of amulets that have come down to us make it clear that the Egyptians were always strong believers in their powers. It is probable therefore that they were only made by temple priests or attendants (Latin, *minister*) who would be able to impart to them, by blessings or incantations, a share of the sacred nature of the temple. It is hardly likely that rooms for the sale of such objects will ever be definitely identified in or near the ruins of temples, though they may well have existed, the ancient equivalents of the shops for the sale of articles of piety that cluster round many cathedrals in our days; but Mr. Quibell found in the "Bes Chambers" of Saqqâreh proofs of the manufacture of certain amulets on sacred ground (*Excavations at Saqqara*, vol. I, pp. 12–14). Further possible evidence of another centre of such manufacture connected with a shrine of Hathor in the XVIIIth dynasty has been suggested by the present writer in *Man*, vol. XXVI (May, 1926), p. 81.

G. D. Hornblower.

THE OBELISK BARGE OF HATSHEPSUT.

A Conjectural Design Based on Rules Evolved from an Analysis of the Lines of the XIIth Dynasty Funeral Barge.

Owing to the frameless structure of Egyptian ships, their design must have been evolved by a set of rules. An analysis of the lines of the XIIth dynasty funerary barge has given the foundation for such a set of rules (*Ancient Egypt and the East*, 1933, Parts III, IV, pp. 100–11), and if the theoretical and the actual agree it may be taken that these rules, if not the ones that were in use, form at least a good working substitute which is sound in principle.

The barge built by Senmut to carry the two obelisks for Queen Hatshepsut is an excellent study to which the rules derived from the funerary barge may be applied. There is a carving at Deir el-Bahri with which the result may be compared.

Before commencing to re-design this lighter it will be well to state briefly the rules for design. Firstly, the overall length was chosen. The greatest width was a proportion of this length, usually $\frac{1}{3}$ to $\frac{1}{4}$. The depth from the gunwale to the bottom of the keel was $\frac{1}{3}$ the greatest breadth. The length of the midship beam was determined by a drawing; also the total number of the deck beams was known. Using half the length of the greatest beam as a radius, a quadrant of a circle was drawn; the base and the arc were each divided into the same number of equal parts, the actual number of parts being two or three more than the number of beams before and abaft the midship beam. Corresponding divisions in the base and the arc were joined, and the length of the joining lines gave the half-length of each beam. The resulting curve through the ends of the beams was termed the "beam curve," and gave the deck plan of the ship. To get the shape of the keel, the beams were put into position with a constant proportion of their length below to give the curve of the keel. The shape thus arrived at is a distorted form of "beam curve." If the beams lay in a straight line the curve would be a "beam curve," but owing to the beams rising at each end to follow the sheer of the deck, the curve of the keel becomes correspondingly raised. The shape of the midship section was determined by filling a certain length of rope with planking and pulling it in until the planking came to the beams. The length of the rope to be filled was again dependent on the length of the beam.

These rules for design as deduced from the funerary barge naturally reproduce that barge when applied.

To apply them to the design of the obelisk barge of Hatshepsut it is desirable to make one or two modifications, which though not affecting the principles of the rules make for convenience in drawing. The carving at Deir el-Bahri shows three tiers of beams. The lowest tier will be taken as the base for the design; this tier would obviously have been the first to be put up. The sections of the ship will be taken as circular arcs, passing through the keel and the beam ends—but solely for convenience in drawing and making calculations. The shape of the keel will be obtained by using a "beam curve" direct on a base through the underside of the lowest tier of beams; this again is to facilitate drawing, instead of setting down a proportionate length of beam below. Apart from these departures, the above stated rules have been strictly kept in the following reconstruction of the barge of Hatshepsut.

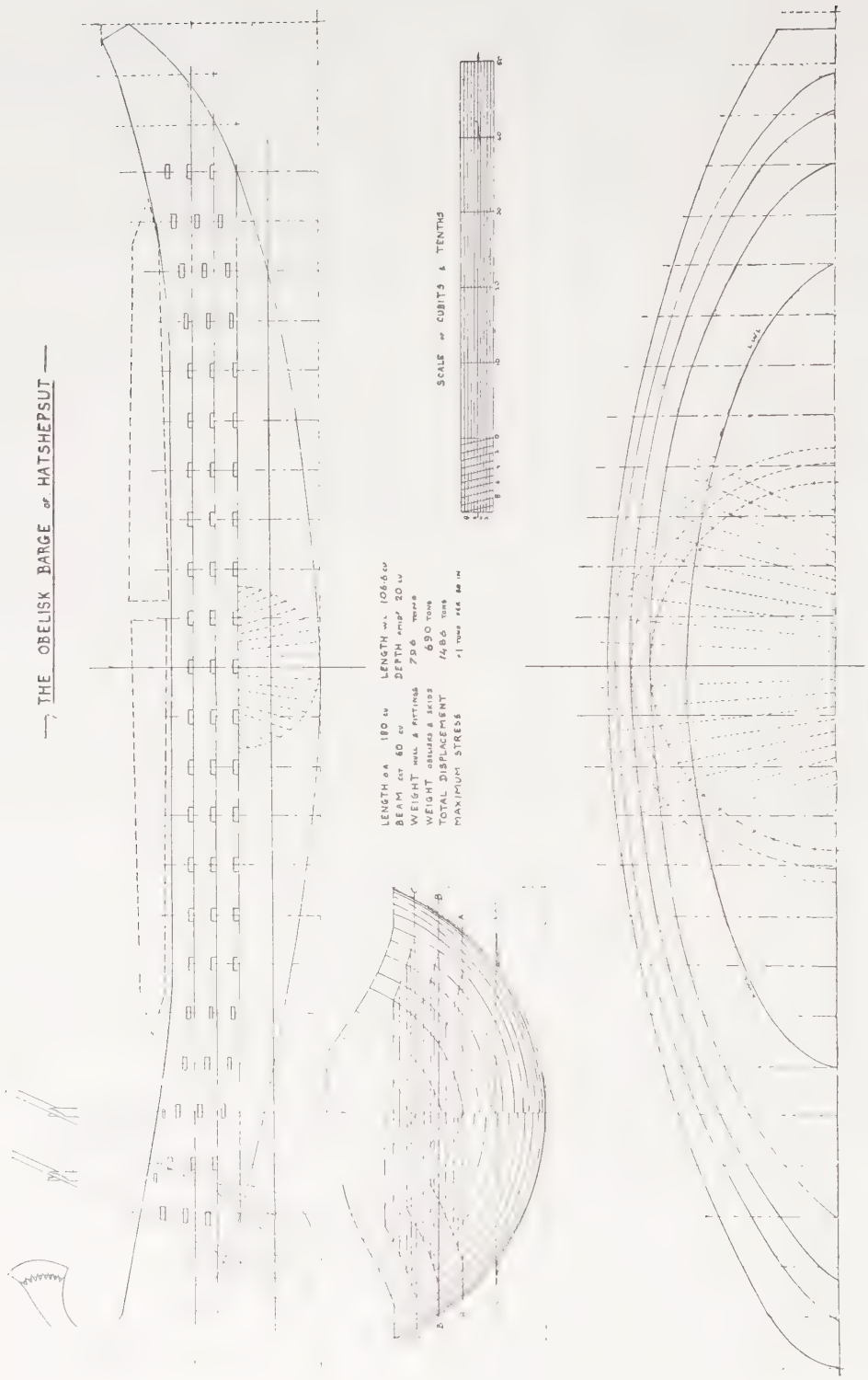
THE OBELISK BARGE OF HATSHEPSUT
SCALE OF CUBITS & TENTHS
LENGTH OA 180 cu
BEAM EXT 60 cu
WEIGHT HULL & FITTINGS
WEIGHT CABINS & DECKS
TOTAL DISPLACEMENT
MAXIMUM STRESS
LENGTH WL 106.6 cu
DEPTH AMID 20 cu
296 tons
690 tons
1486 tons

FIG. I.

During the XVIIIth dynasty there were two barges built for the conveyance of obelisks. The first was built by Ineni to carry a pair of obelisks for Thothmes I ; the other was built under the supervision of Senmut to carry two larger obelisks for Hatshepsut. Of these two barges Ineni gives the size of his as 120 cubits by 40 ; whereas Senmut shows a lovely picture. In both cases the actual obelisks are still in existence, Thothmes' 64 feet long and Hatshepsut's 97 feet.

Taking a proportionate length Senmut's lighter should be $\frac{9}{6}\frac{7}{4} \times 120 = 181\frac{7}{8}$ cubits. The length of Senmut's lighter may be taken as 180 cubits ; the breadth will therefore be 60, and the depth from gunwale to keel will be 20 cubits. These are the main dimensions of the barge.

Reference to the Deir el-Bahri carving shows that there were three tiers of beams, and 22 beams in each tier. To choose a simple figure, let the underside of the beam tiers amidships be fixed at 3, 6, and 9 cubits below the gunwale. A drawing of an arc of a circle with a chord of 60 cubits and a depth of 20 gives the shape of the midship section and also the length of the midship beam of each tier. If the beams be numbered 1 to 22 from forward, number 11 may be taken as the midship section. The length of the midship beam works out at 48 cu. 5 palms. This is tier A as shown in the drawing (fig. 1).

There are to be 22 beams, and these may be allowed to extend over a length of 140 cubits leaving 20 cubits at each end. The spacing of the beams centre to centre will be $6\frac{2}{3}$ cubits. To obtain the length of the beams use the half-length of the midship beam as a radius and draw a semicircle ; that is, one quadrant for the fore end and one for the after end. As there are 22 beams, there will be 10 beams before the centre and 11 beams abaft the centre, since No. XI has been made the middle beam.

According to rule, the base and the arc are each divided into a number of equal parts, this number being more than the number of beams. In the case of this ship three more divisions are taken, so the forward quadrant is divided into 13 spaces, whilst 14 is the number of spaces for the after part. Corresponding points on the base and the arc being joined, the lengths of the joining lines are the half-lengths of the beams in the lower tier. To obtain the beam lengths for the two upper tiers, B and C, the easiest method is as follows : take the length of the centre half-beam from the midship section in each case. These half-lengths measure 26·72 cubits and 27·86 cubits respectively. Use these half-lengths as radii and draw two concentric semicircles outside the original one. Extend the joining lines of the lower tier until they cut the outer circles and use the lengths thus obtained as the half-lengths of the beams in tiers B and C. The rules for design as obtained from the funerary barge only applied to a normal ship with one tier of beams. This lighter is an abnormal ship, and the most convenient method of getting beam lengths may be justifiably used. The beam lengths being known, the next step is to determine the rise of the beams at the ends of the ship to give a reasonable sheer. Here some quite simple rule can be adopted. A convenient sectional area for each beam is $2 \times \frac{1}{2}$ cubits. Place beams V to XVII on a straight line, leaving four beams forward and five beams aft to be lifted above the general level. The most simple proportion in which to raise the beams is $\frac{1}{2}$ a cubit, then 1, 2, 3, 4 cubits. By these methods three points on each side at every beam station have been found, and are put into the body plan of sections.

The next step is to determine the shape of the keel. By rule, a constant proportion of the length of each beam should be set down from the lowest tier.

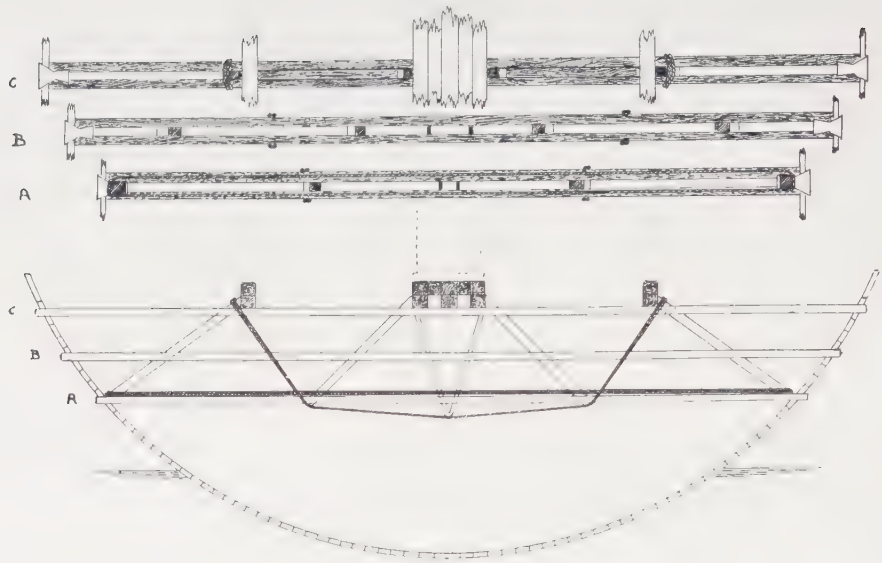

FIG. 2.—MID SECTION. ($\frac{3}{4}$″=10 CUBITS.)

This, of course, would make the curve another beam curve if all the beams were in a straight line. As, however, the beams themselves rise above the level and also the proportion at the ends is slightly decreased, the curve so obtained would be rather steeper at the ends than a true "beam curve." A departure from the rule in practice but not in principle is justified here; a new beam curve using the depth below tier A, that is 11 cubits, as a radius is drawn. In order to make the ends steeper use the exact number of spaces instead of a greater number, as was done in obtaining the deck plans. For the forward end 10 divisions of the arc and base are taken, with 11 divisions for the after part, which makes the line of keel pass through the level of the lowest tier of beams at each end beam. This method gives a fair compromise on that called for by rule and is also less trouble to draw. Enough points have now been obtained to draw arcs of circles for each section and so to complete the body plan. There still remain 20 cubits at each end of the ship beyond the beams to be accounted for. These ends can be finished off to look well, and also a nice sheer line for the top of the gunwale can be drawn in.

The completed drawing in fig. 1 gives the shape of the big lighter as it would have been according to the rules that we believe obtained for shipbuilding in ancient Egypt. It has now to be seen whether it would have been a suitable vessel for the purpose for which it was intended. To find this out, the weight of the hull and load must be calculated, for which modern theoretical naval architecture must be called in. Senmut, of course, had no need to make calculations; he simply placed his two obelisks on board and saw that the barge floated at a proper trim. With a design only on paper calculations must be made; and we must be satisfied that the ship was strong enough to carry the load.

It would be out of place here to give all the calculations in detail; the results only need be quoted.

Unfortunately, or may be fortunately, there is no information whatever on the interior of this great barge. It is therefore possible to choose any convenient structure that is strong enough to carry the load. Fig. 2 shows a

possible arrangement. The hull as in all Egyptian ships is without framing. This means that it must be considered as an arch, and the load must be carried on deck, *i.e.*, on a trussed girder. That the Egyptians were familiar with the use of rope trusses is shown by the hogging trusses fitted in sea-going and cargo ships ; that they used diagonal struts is proved by examples of furniture in which light diagonal bars are fitted to carry the load. In the proposed framing only the top and bottom beams are taken as part of the girder. Four diagonal struts are required, and the two centre ones under the obelisk have no load on them until the vessel rolls. Rope bracing where shown is used for those parts of the girder which are in tension. The beams are made up of two side-pieces with the centre filled in solid where the greatest pressure comes. The greatest load comes out at about 1,500 lbs. pressure per square inch, which though rather high for timber is by no means an impossible load. The centre tier of beams is used only to tie the sides of the ship together, and does not help directly to support the load. A strong fore and aft platform forms a beam on which the obelisks rest, and gives longitudinal strength to the hull. Two side girders also hold the ship together and act as a lodgment for the outer struts. The whole structure would be firmly pegged and tenoned together in the usual Egyptian manner. The drawings show the plans of each beam, as well as the section of the ship.

No deck is actually shown in the drawings, but one must be allowed for, as the gangs of labourers must have had somewhere to stand when dragging the obelisks on board. It really need not extend to the sides ; between the centre and side girders would give ample working space. Another point to be borne in mind is that all the beams had to be lifted by man-power into their places ; the Egyptians had no cranes or screw-jacks. The size of the timber is consequently limited by the weight that one man can lift. The cross-section of the beams is arranged to be $2 \times \frac{1}{2}$ cubits and the weight of this is about 140 lbs. per foot run. One man on each side of the beam, and a pair of men every two feet, would give each pair of men 280 lbs. to support, a load that can be man-handled without undue effort.

Having arranged for a suitable transverse section the only remaining detail to be settled is the thickness of the planking. Let this be taken as 2 palms, or about 6 inches. This thickness can be modified later if it is found that the hull is too heavy, or the strength is deficient.

With these points decided on it is possible to calculate the total weight of the ship and the position of its centre of gravity. The calculation is more tedious than difficult. The results in English tons are :

Planking of bottom, including gunwales	344·89	tons
Truss girders and tie-beams to carry obelisks	154·20	,,
Fore and aft girder under obelisks and at sides	160·93	,,
Decking at ends and working platforms	77·90	,,
Rudders, 4 in number	28·16	,,
Truss ropes fore and aft	15·00	,,
Total for lighter	781·08	,,
Obelisks and skidding for transport	690·00	,,
Total weight	1,471·08	,,

In addition, a small allowance for the crew and minor deck erections must be made, for which 15 tons should be ample, making a grand total of 1,486 tons.

As the total weight of the loaded ship is now fixed it is possible to ascertain the water-line at which she will float. To do this draw a line at a guess and calculate the volume of the hull below it; also calculate the position of the centre of gravity of this volume. The volume multiplied by the weight per cubic foot of water gives the displacement weight of the ship and its load, and this must be equal to the total weight. If the line chosen does not give this equality, another must be drawn until a balance is achieved. The centre of gravity of the displacement volume must also come vertically under the centre of gravity of the hull and load. Adjustment can be made in this latter centre by altering the position of the obelisks on the barge.

The water-line shown in fig. 1 cuts off a displacement of 1,486 tons, and the position of the obelisks has been so arranged that the two centres of gravity are in the same vertical line. In other words, the drawing shows correctly how the lighter will float. The maximum draught at this level is 6·7 cubits, or 11·54 feet. This is not too deep for successful navigation on the Nile.

It has now been shown that by using the rules derived from the funerary barge a design for a lighter to carry two obelisks end on can be arrived at. The next question is whether the lighter having a construction as shown in fig. 2 would be strong enough to carry the obelisks. The forces on the lighter are due to the load pressing down and the water pushing up. Owing to the overhangs and also the comparatively uniform load, the tendency is to hog the barge; that means the barge wants to bend so that the ends droop, and the centre comes up. The greatest upthrust of the water is amidships, and it diminishes to nothing at each end of the water-line. The keel of the barge will be in compression, and the gunwales and the fore and aft girders will be in tension, the maximum tension amounting to about 250 lbs. per square inch. This hogging strain is further relieved by the fore and aft rope trusses fitted above the obelisk.

A further point to be considered is whether the barge when loaded would have floated upright, or whether it would have been top-heavy. On account of the circular sections, all the lines of pressure of the water act through the centre of the circular arc, which is 12½ cubits above the gunwale line. The load lies well below this point, so that stability is assured.

The lighter as designed is thus satisfactory in all respects, and would do the work required. The rules for design do evolve a suitable ship; but is this ship anything like the one that Senmut built?

It must here be assumed that the carving at Deir el-Bahri is an accurate drawing to scale of Senmut's barge. In fig. 3 our design is brought to the same length as the picture of the carving in Naville's "Deir el-Bahri" (Egypt Exploration Society's publication). On superimposing a tracing of this picture of the carving (fig. 3A) over the design (fig. 3), the agreement between the two is seen to be remarkable. The water-line in the carving is exact in position, though a trifle longer aft than in the design. The bow of the design which was put in to please the eye is perhaps rather higher than Senmut would have wished. The position of the beams, particularly amidships, corresponds nearly exactly; the somewhat irregular spacing of them in the carving may perhaps be put down to bad draughtsmanship. The over-all length of the carving is rather more than that of the design; but as the ends of the original carving are now missing and the lines shown are merely conjectural, this discrepancy becomes a matter of no moment.

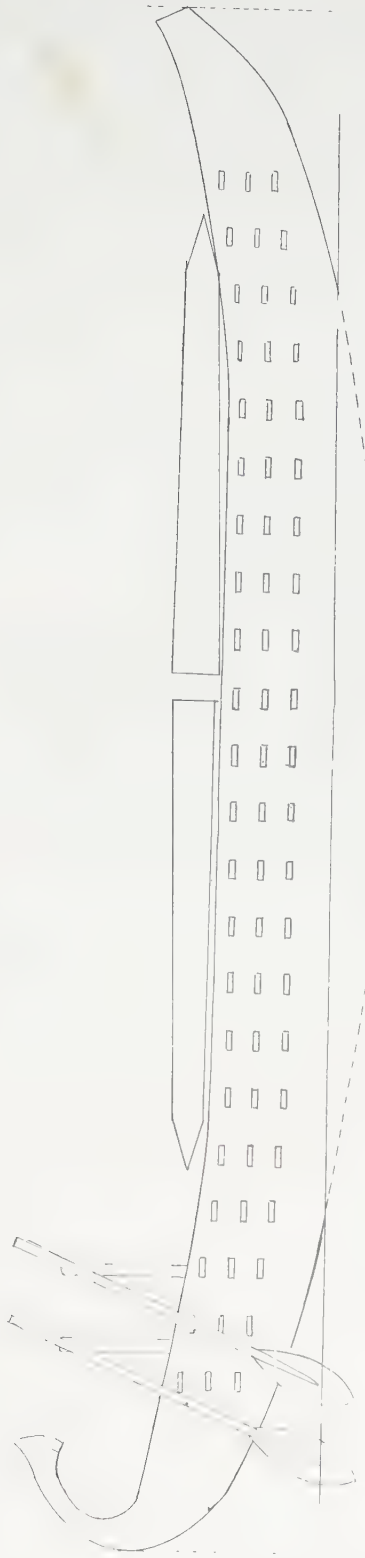

FIG. 3.—OBELISK BARGE AS CONSTRUCTED ACCORDING TO RULES FOR SHIP-BUILDING DEDUCED FROM XIIITH DYNASTY FUNERARY BARGE.

This remarkable agreement between the lighter as designed and the carving proves two things. First, that in essential details the carving is to scale, which measurement shows to be $\frac{1}{35}$, or 1 palm equals 5 cubits. The only error in the carving lies in the size of the side of the obelisks; it is probable that Senmut gave the sculptor the main measurements of his barge and the lengths of the obelisks, but omitted to state the size of the side. The other fact that emerges is that the rules for design evolve a ship similar in every way to that built by Senmut.

Two apparent errors may be seen. The position of the rudders in the design does not agree with that shown in the Deir el-Bahri carving. Actually, the carving shows four rudders, and the pair on one side appear in fig. 3A. If, however, the pair on the other side had been shown instead, the rudders as placed in the design would have agreed with the carving. This apparent error is due solely to the Egyptian custom of showing things which are side by side as one before the other.

The placing of the obelisks in the design is about 10 feet ahead of those in the carving. This was necessary to make the designed vessel trim correctly to the water-line as calculated; but this discrepancy does not affect the fact that the rules for ship design derived from the funerary barge of the XIIth dynasty do produce the type of ship that was built in ancient Egypt.

Since the Deir el-Bahri carving of the obelisk lighter is true to scale, it may safely be assumed that the ships of the Punt expedition are also to scale; in this case $\frac{1}{14}$, or 1 palm equals 2 cubits.

The obelisk lighter of Queen Hatsepshut was probably the largest ship of the ancient Egyptian type that was ever actually built. It was not, however, the largest that was contemplated. The unfinished obelisk at Assouan as originally lined out would have weighed over 1,000 tons; and it is unlikely that it would have been started unless the contractor had anticipated that he could transport the finished article down the river. For this a lighter of about 2,000 tons loaded displacement would have had to be built.

Various suggestions have been made concerning this obelisk lighter. One, that it was a wooden box built round the obelisks, must be rejected on the ground that it would have required a framed structure, an idea quite foreign to ancient Egyptian ideas of shipbuilding. Another suggestion is that the lighter was really a solid raft. The timber available in Egypt suitable for the construction of a solid raft would have weighed about 40 lbs. per cubic foot, that is, rather more than half the weight of water. When the upper surface was level with the water, it could have carried a load of 22 lbs. for each cubic foot. In other words, to carry a 700-ton load at least 1,400 tons of timber would be necessary, just about double the amount needed for a ship of normal type.

It may, therefore, safely be assumed that the Deir el-Bahri carving of the obelisk barge of Hatshepsut was an eye-witness's representation of the actual lighter.

C. D. Jarrett Bell, R.C.N.C. (retd.).

THE GOD 'ASH.

Owing to the early use of writing in Egypt it is possible to obtain some knowledge of the civilisation of other countries at a period when those countries had no written records of their own. This is more especially the case in regard to religion, and perhaps the most marked example is the god 'Ash. He occurs only five times in the whole course of Egyptian records, and the rarity of the occurrences would in itself suggest that he was a foreign deity, but other proofs are also available.

On sealings of the IInd dynasty (Fig. 1) 'Ash is represented as a human figure with the head of the fabulous animal of Seth, and wearing the crown of Upper Egypt. The sealings are from the royal tombs at Abydos (Petrie, *Royal Tombs*, II, pls. xxii, 178, 179; xxiii, 199, 200) and Naqada (de Morgan, *Tombeau Royal*, figs. 816, 819), the names of the Kings being Perabsen and Kha-sekhemui, in whose titularies the figure of Seth always occurs. On each of these sealings 'Ash is associated with a royal vineyard, suggesting a fertility connotation.

Fig. 1.

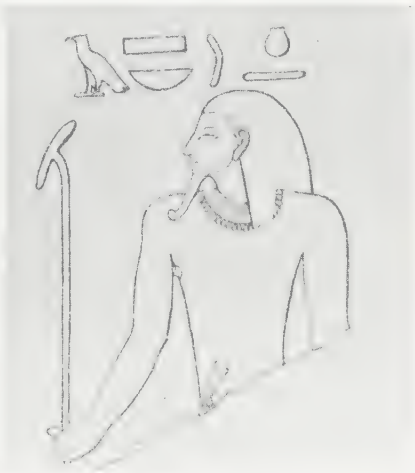

Fig. 2.

The god occurs again in the Vth dynasty (Fig. 2) on a sculptured slab of Sahure' which shows the spoils taken by the Pharaoh in his Libyan campaign (Borchardt, *Sahure'*, p. 17, Abb. 11). 'Ash is here depicted in human form with no special attributes, and is called *nb Ṯnnw*, "Lord of Libya". With him is the goddess of the West, and from their position with regard to the booty it seems that the two deities are presenting it to the victorious raider. As *Ṯnnw* can also mean olive-trees there is again a fertility connotation.

In the Pyramid Texts of Pepy (Fig. 3) there is a spell referring to 'Ash, but though the sentences can be translated, the meaning is obscure, probably because of our ignorance of the allusions. "His words are heard by the Ennead of the Gods. Neither his possessions nor the possessions of his house belong to 'Ash, who devours his body."

There is, as far as I know, no mention of 'Ash in the Middle Kingdom, but

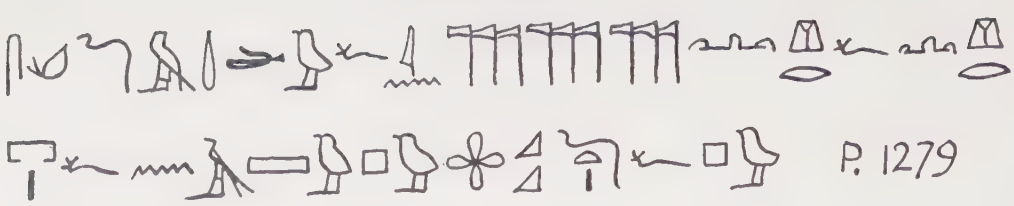

Fig. 3.

in the XVIIIth dynasty he occurs in the Book of the Dead (Fig. 4) in what appears to be a rain-making spell. "I am the Terrible One in the thunder-storm. . . . I am refreshed by this 'Ashu. I have acted for the Great One in the battle. I have established the flint-knife among the flint-knives which are in the hand of Thoth in the thunder-storm." The allusion to flint-knives in thunder-storms is peculiar, having regard to the belief in "thunder-stones" in Europe. In three out of the four occurrences of his name, 'Ash is evidently a god of the fertility of the earth; in the IInd dynasty he is associated with vineyards, in the Vth dynasty with olive-trees, in the XVIIIth with rain.

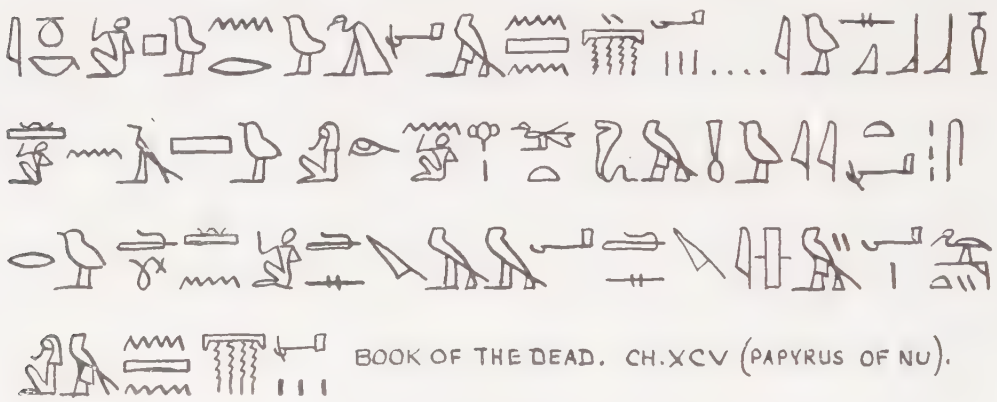

Fig. 4.

The latest reference to 'Ash in Egypt (Fig. 5) is on a coffin of the XXVIth dynasty, now in the Brighton Museum, and published by Mr. Alan Shorter in the *Journal of Egyptian Archaeology*, vol. xi (1925), p. 78. The god is represented in the conventional artistic style of the period, but with certain peculiarities. He has three heads, a lion, a vulture and a snake, the last being bearded and wearing the crown of Upper Egypt. Multiple-headed gods are always rare in Egypt and are, I think, foreign deities and not indigenous. The snake is interesting for it appears to be the hoodless cobra, which is well-known in northern Egypt and is as deadly as the hooded variety. Other peculiarities of this figure of 'Ash are that he wears no tail as was usual in representations of gods after the XVIIIth dynasty; he also has an unexplained band across the chest and he carries a snake head downwards in his hand. His name is given as "'Ash of many faces in the midst of Maz" [the place-name may possibly read Diz]. The other inscriptions on the coffin are the usual prayers to Osiris for the dead and contain no further reference to 'Ash, nor are the other deities on the coffin in any way uncommon.

The latest recognisable representation of 'Ash was published in 1545 by Sebastian Münster in his *Cosmographia Universalis*. In this Münster gives an account of Marcomir, the first king of the Franks, an entirely legendary character.

Fig. 5.

Fig. 6.

Marcomir, who was of Trojan descent, reigned in Scythia, but being unable to withstand the invasions of the Goths he decided to seek his fortune elsewhere and to lead his followers to another country, though to which land he could not determine. He therefore consulted a witch (*ein zauberin oder hex*), named Alruna, who by her magic and sorcery caused a demon (*Abgott*) with three heads to appear by night to the king. The figure of this demon (Fig. 6) as depicted by the 16th century artist bears so remarkable a resemblance to the representation of the god 'Ash in the XXVIth dynasty that the likeness cannot be accidental. The differences are only in the style of art of each period, but in both there are the heads of the same three creatures, in both there is the same band across the chest marking the edge of the ritual mask, and both wear a loin-cloth. This last point is interesting, for a European demon in a loin-cloth is unique in the annals of witchcraft. The German author calls the snake a toad, but the neck of the creature shows that it is certainly a snake. He also calls the bird an eagle, but this again is clearly wrong for the bird is a vulture, and the artist has even indicated the thin feathers on the neck so characteristic of the Egyptian vulture. Münster unfortunately has not recorded the name of Alruna's demon; his identification with the god 'Ash rests therefore on the close resemblance between the two figures.

That such a deity should survive in the less frequented countries is not surprising. In Egypt the cult of, and belief in, the indigenous deities died with the introduction of Christianity, but 'Ash was not Egyptian, he belonged to a northern, perhaps to a western, people. He had therefore a longer term of recorded life than any other god, beginning in the IInd dynasty and lasting till the middle of the 16th century of our era.

M. A. Murray.

REVIEWS.

Teleilāt Ghassūl. By A. Mallon, R. Koeppel, R. Neuville. 4to., pp. 193, 72 pls., 66 figs. 1934. (Rome, Piazza della pilotea 35.) Frs. 140.

This is a worthy record of discoveries in the Dead Sea plain, which had not yet been explored, and it proves a considerable civilisation to have existed there at an early period. There was at first a talk of these sites being the Cities of the Plain, *i.e.*, of the age of Abram, 1800 B.C.; and this age still seems to be favoured as the changes during 4000 years are named, pp. 25–6.

It is unfortunate that the writers have not compared the results with those published three or four years ago from the prehistoric sites near Tell Fara in the Wady Ghazzeh (*Bethpelet II*). In that valley a series of Neolithic sites were found, ranging from the period of the triangular hoe to the straight hoe, and closed by a site of the earliest Copper age. In this series, about half way, there was an intrusive people found, who did not drive out the aborigines, but disappeared after a generation or two. That they came from the Jordan valley was inferred from their introduction of basalt vessels. Their period was middle Neolithic.

Now it appears that this was all one with the civilisation of Teleilāt Ghassūl, and so dates that. The flint points, fan-shaped large flakes, square-ended hoes, millstones, maces, bone points, bodkins, stone beads, flat figures with stump arms, pottery dogs, bowl patterns, matting, finger prints on ledge handles, flat-based jars, pottery spoons, conical silos, basalt bowls on stands, long conic pots, red line painting, and rectangular houses—all this apparatus of civilisation was alike in both places. Teleilāt Ghassūl lasted rather later, having coarsely cast bronze hoes in the topmost stratum. The age of this Jordan civilisation is therefore long before the Ist dynasty, probably well before 4000 B.C., from middle Neolithic to early metal.

It is then, to our readers, mostly of interest where it exceeds the range of the products already familiar to us in the Wady Ghazzeh. The bronze tools of the latest level seem to have been roughly cast in moulds; they have 7 per cent. of tin, which was not in use in Egypt till much later. The calyx-shaped bowls on tall pedestals are peculiar; they belong to the latest levels.

The paintings on the walls are quite unknown elsewhere, and are astonishing. There only remain the lower legs and feet of figures, a black form approaching three red seated figures having feet raised on stools; a scene of worship of the gods or ancestors. Another chamber has some ghastly black heads with white eyes, called "birds," but enigmatical. Yet another chamber has a great star device with eight rays, alternate red and black. In the centre an eight-pointed star, and yet another in that. Various scraps of figures are scattered around, but indistinct. There is at least a small boat with fore mast and red sail, and two other possible boats, white on black, and red. A slim red figure with black outline holds out a black conical object. There is also an animal with large ribbed horns. The whole needs study of the original with some familiarity with the Hierakonpolis tomb and other mural paintings.

Such a fully illustrated account, having due regard to the four successive strata of the site, is very welcome, and will long serve as a source-book for comparison with other discoveries. F. P.

La Technique des Fouilles Archéologiques. By Comte du Mesnil du Buisson. 8vo., pp. 256, 7 pls. 1934. (Geuthner, 13 rue Jacob, Paris, VI°). Frs. 60.

Every excavator should read this detailed and comprehensive guide, and judge how far his own practice might be improved by it. In the first place it is strictly logical to begin with the outline of the three years' course of training at the École du Louvre : but the logical order of any subject is seldom the most effective in teaching. It is usually best to learn by practice under an effective master. The École may teach (*a*) the principles, (*b*) work on cemeteries, (*c*) work on towns, but it does not seem to teach the training of workmen, which is the most essential means of success. Happily the Count is too good a humorist to neglect that, and he is emphatic on friendly relations with all nations, the stimulus which *bakhshish* gives to observation and care, and the collection of information and objects from all quarters that lie within reach. The devotion of the men to the work, and their good faith, is to be cultivated by profit-sharing in good fortune. There should be no confiscation, and the State should prove itself to be a good purchaser and honest.

There is, however, a fly in the ointment when he recommends that the village *omdah* or sheykh should be consulted about wage rates, that the *reis* should call up and name the men on pay day, and that men may be made up into gangs of ten to be easier to reckon with. All that means the lack of personal knowledge about each worker, and the interference by the means of corruption between master and man. Any *omdah* in Egypt would name the highest wage rate in order to levy part from the men afterwards : any *reis* would expect to exact something as a go-between : and no man feels his duty personal unless he is known by his own name, and not in a collective group. We used to distinguish in the dark the foot-fall of many of the men. The special quality of each man should be observed, that his work may be fitted to him. One will excel in tracing walls, another in pioneer hunting, or in heavy uniform slogging, or in minute detail, or in delicate clearing of a grave without shifting a single object. Certainly the most effective work is obtained by fitting it to the man who does it by instinct.

The light railway system for shifting earth is naturally to the fore ; but for short distances the use of children to carry baskets is recognised, and there is the advantage of a second search of the earth as it is showered from the baskets. For discoveries a successful child should get a full reward, and the digger be told what he has missed—a potent stimulus to attention. The daily amount of earths of various solidity that is moved agrees well with experience in Egypt. The general directions about observation and method are what have also been reached by other excavators.

It may be useful to state other methods of work which the Count does not seem to notice. In survey over a field of work it is best to set up lines of poles at, say, 50 metres or 2,000 ins. apart, forming a regular squared grid of lines. Then it is only needful to take measures from any point to any two of the crossing lines to fix the place, and it can be rapidly plotted on squared paper. On small areas, and in the interior of tombs or graves, the method is to peg two strings at right angles, and then plot off on squared paper the distance from any point to each string ; the plan is finished as it proceeds, and any discrepancy is seen at once. The level should be written at top and ground on survey poles, and on a key plan. For any object to be levelled, plant a measure on it and read off to any levelled pole against the sea or some distant horizon.

The pot of melted paraffin wax, and primus stove, is essential for preserving

any delicate object, especially skulls, and should be in daily use for such things. Salt or saltpetre should never be removed by soaking, but by laying the sculpture on, or in, damp sand, leaving the rough face exposed to drying. A crop of salt will come out every day, to be brushed off, so long as any remains in the stone, and the face is perfectly uninjured.

In photography use a stop of F/100, and it is needless to be careful about focussing.* Never use hyposulphite, but leave the developed film to dry after a wash: it will not spoil in sunlight, and the clearing and washing can all be done by the printer. In copying inscriptions, turn back each line as copied, so as always to place the fresh paper immediately below the original subject; this gives more accuracy and makes omissions impossible.

Dry squeezing on paper is not only for black-ball copies, but also to provide an accurate outline for hand-drawing.

The great use of reference-slips for classifying information leads to too much paper work. It is generally best to make all notes of place or nature on the pencil drawing of each object; ink in only what is for the plates, and use the pencil notes in writing up the text of plates. For notes about ground or structures, write on the field plans; from these the selection is made for permanent notes on the unified plan published. *Fiche* devotion becomes an end in itself. Use squared paper, in light blue lines, for all plans and drawings; 4 mm. or 1/10 inch is close enough for plans, and double this distance for objects. Every note that is unnecessary is a mere obstruction.

For tomb registers it is best to have cards, with printed title for every observation that should be made; usually sketch plans are put on the back of the card. Such cards are the size of a usual envelope, and stiff to keep flat in the pocket; two or more can be used for complex cases.

For registration of the objects from a town, use three letters (region, house, and chamber) and level; also the type in a *corpus* of types—this *corpus* extends to 5,500 figures for Palestine already.

In the preparation of the final account it seems best to give first a statement of all the dating points, and to discuss the periods completely. Then the reader feels assured of the historic values in following the descriptive account. As far as possible have each plate self-explained, with notes, and lettering on detail in views, so as to save reference to text. Every plate should have at the top the scale, locality, and nature of objects, as such plates are often wanted loose for classification by subject.

Every excavator will have his own methods, varying by inclination and place, but each should at least know how others work in order to select the best available course. F. P.

Ancient Oriental Seals of E. T. Newell. By Von Der Osten. 4to., pp. 204, 41 pls. 1934. (University of Chicago; Cambridge University Press.) 27*s.*

This is far more than a catalogue, for it comprises a classification and discussion of all the types of Oriental seals. A shaded diagram happily shows the range of period and of country of each large class. The catalogue fully describes the subject of each of the 695 cylinder seals, with cold impartiality; a more personal appreciation and linked discussion of the subjects would have been a welcome addition. There follows a discussion of each type of God

* Use only F/100 in sunshine, F/22 for skylight, F/8 for interior, then the suitable length of exposure can more readily be estimated.

according to local groups, also of the Priests, Animals, Dress, Flowers, Emblems, Mountains, Buildings, Chariots, Altars, Furniture, Standards, and Ornaments. Then comes a description of Scenes. All inscriptions are transcribed and translated. A long bibliography states all work connected with the subject. There is an index of every mention of each seal. The collotype plates show all the seals well and clearly. It would be hard to render a more complete account of any detail of the subject, and it will be a text-book for students. F. P.

Nan-Shan-Li. Brick Tombs of the Han Dynasty near Port Arthur. English text by KOSAKU HAMADA. 4to., pp. 40, 53 pls. References to many figures in 115 pp. Japanese text. (Far Eastern Architectural Society.)

These tombs range from the Ist century B.C. to the IIIrd century A.D. The dated bricks are from 40 to 404 A.D. The most striking objects are the house models in pottery; they are only of a single chamber, and therefore are soul-houses giving a shelter, but without the domestic details of such soul-houses in Egypt; there are separate models of cooking stoves and pots. The chambers of the tombs have round arched roofs with two rows of voussoirs. There are various patterns in relief on bricks to serve for ornamental bands. Some lacquer-work cases remain, and the iron tools are of Asiatic forms. This volume is another of the splendidly illustrated and complete accounts which are the mark of Japanese archaeology. F. P.

Iraq Excavations. Third Report, 1932–3. By HENRI FRANKFORT. 8vo., pp. 92, 83 figs. 1934. University of Chicago.

This is mainly occupied by Tell Asmar work, which examined five strata, reaching back to the age of the great tombs of Ur. Houses of that period are here planned, with the later Akkadian continuation; these were at first an open court with four or five rooms round, and later seven or eight rooms. The doorways were arched. The earlier pottery is very ugly; in Sargonid times it was little better, and clumsy pilgrim bottles had begun. The alabaster head of an Akkadian is harsh and heavy-featured. The Akkadian palace had 36 rooms and a central court. There were many bathrooms and latrines joining a sewer which ran below the front of the palace. The main motive in the jewellery is a disc with pierced radiations. Amulets have a lion head or bull head. A hoard of copper work includes the shell-shaped lamp of Ur, a strainer with long handle, and a copper tube. The last explains what the tubes were, from which seated figures are drinking; a seal impress shows comic figures of a lion and a donkey seated upright sucking at tubes. The copper tube is curved, 28 inches long with perforations at one end; these suggest that it was used for drinking muddy beer. The Tell Halaf sculptures are accepted as dating about 1500 B.C.

A small temple, a single chamber, long and narrow, belonged to Abu, the god of vegetation. In it were square plaques of limestone with groups of adoration; the central hole so usual in these plaques is considered to have served to peg them to a wall.

Part of a cylinder of clear blue glass was found, dating to 2600 or 2700 B.C. The bronze tools had $7\frac{1}{2}$ per cent. of tin. Iron was used for tools before 2700 B.C.; it is certified as such by Prof. Desch, who states that it is not meteoric iron.

The town of Khafaje has been further worked outside the fortified ring of enclosure. The simple gate in the ring had been covered by a larger recessed gate in later times. The buildings extend from the Jemdet Nasr period to

Sargon. At Khorsabad a temple of Nabu has been excavated, with a stone pavement and walls still fifteen feet high.

At Jerwan a long aqueduct of large blocks of stone has been traced, bringing water some thirty miles from the hills to irrigate Nineveh. It was built by Sennacherib, and bridged a ravine 900 ft. wide. F. P.

Egypt and Negro Africa. By C. G. Seligman. The Frazer Lecture for 1933. Pp. 82, 2 pls., and a map. (Routledge, London.) 3*s.* 6*d.*

This book has for its main thesis the belief and customs concerning Divine Kings in Africa; the secondary theme is "to show that Egyptian influence did in fact penetrate to the very heart of Negro Africa." Professor Seligman, however, points out that many customs and beliefs held in common by Ancient Egypt and Modern Africa are merely indications of "the wide diffusion of old Hamitic blood and ideas." This is an important point, for to the mere Egyptologist it appears odd, to say the least, that so much "Egyptian" influence should have survived the continuous change of population, by conquest and immigration, which has taken place in Africa during the last two thousand years. The northward drift of culture has not been seriously considered; yet it is surely possible that when the Ethiopian king, Tirhaka, performed the ceremony of shooting arrows during the *Sed*-festival, he had brought that ceremony from the south. Even the other examples of arrow-shooting during an ancient Egyptian royal ceremony were performed under the auspices of the god of the south. Apart from these doubtful points the book is not only well worth reading but well worth keeping for reference, for the author has collected into a small space practically all the information as to Divine Kings in Africa. Appendix 2 is peculiarly interesting as showing methods of desert travel in pre-camel times, when donkeys were the only means of transport. M. A. M.

Ancient Gaza, IV. By Flinders Petrie, F.R.S., F.B.A. Pp. 21, pls. 70. 1934. (Bernard Quaritch.) 40*s.*

Sir Flinders Petrie sets an example to all excavators in the rapidity of publication of his excavations; any knowledge obtained is thus at once available for other workers. The new volume, *Gaza*, IV, continues the story of the excavations at Tell Ajjul. Among the most important finds are the scarabs, of which more than five hundred were discovered. As might be expected, most of these were Canaanite imitations of Egyptian work, generally of the New Kingdom; but the actual Egyptian scarabs take the date of the site back to the XIIth dynasty with the name of Amenemhat III. The most interesting as well as the most spectacular objects were three hoards of precious metals, probably jewellers' or dealers' hoards for re-melting and re-using. The granular goldwork is specially worth noting, for it is known in Egypt as a foreign importation in the XIIth dynasty, and at Gaza it is also foreign. The original home of this highly skilled method of gold-working is still to seek. The necklets and earrings of twisted strips of gold are so closely related in type to Irish prehistoric torques that a connection between the two countries is indicated, though whether that connection was direct or indirect cannot yet be determined. The units of weight of the gold objects found in graves and hoards during the last four years of excavation are extremely important, and taken in connection with actual weights found on the site show a wide range of contact, indicating the amount of foreign trade. In his concluding remarks Sir Flinders Petrie points out that "at Gaza the more advanced works of a higher civilisation were

imported from foreign lands which lay north. This unknown civilisation is now one of the problems of the Near East." It is this problem which Sir Flinders has set himself to solve. M. A. M.

Measures and Weights. By Sir Flinders Petrie. Pp. x, 22. (Methuen and Co., Ltd.) 2*s*.

This book for those engaged in practical work epitomises very clearly the present state of knowledge of a fascinating though hitherto curiously neglected subject. In his preface the author censures the wilful neglect of excavators who " often find stones (weights) like that " and disregard them, thus " throwing history away all the time." They lose sight of the evidence of great movements of people, of ancient international relations, in fixing their attention upon objects more beautiful in themselves but often of little more than local importance.

This book should have a much wider appeal than merely to the metrologist. Here is matter to interest the " man in the street," that is eminently readable and full of interest. Figures there are, of course, but only the essentials, and not in such masses as to be indigestible. Weighing and measuring are the basis of all scientific and commercial enterprise, and at any period reflect accurately the state of civilisation of a people.

Here is summed up for us what is known of the history and evolution of the ancient weights and measures, mass, linear and capacity, what can be said for certain of the descent of some modern measures from them, and what still remains to be done.

For the practical metrologist, there is no wild theorising on scanty material, but the results of nearly half-a-century's work in building up the magnificent collection at University College, London, and collating the evidence of it and other large collections.

One word of warning ; before examining the graphs on page 14, first read the author's note on how to read them (page 13) ! Otherwise you will almost certainly miss the point, for they are not as other graphs. Yet, a little reflection will convince you that in no other way could the information be conveyed so concisely. T. G. Skinner.

Zur Indus-Schrift. By P. Meriggi. Pp. 44. 1934. (Reprinted from *Zeitschrift der Deutschen Morgenländischen Gesellschaft*, vol. XII, parts 3–4.)

This is a very clearly written article. In it the writer submits his main results for criticism, pending a longer work which cannot be printed at present. He claims that even sceptics must admit that he has put forward a coherent system of meanings which are confirmed, or at least not refuted, by any fresh evidence which is at all intelligible ; further, that the system itself cannot be wholly wrong even though certain meanings which are not dependent upon others may be so.

The seals are referred to by Arabic numerals preceded by " No." (or by H. for those found at Harappa) ; the tablets by Roman numerals. In general the signs are rendered by Arabic figures in italics, from Gadd and Smith's *Sign Manual* (pls. CXIX–CXXIX), but those of most frequent occurrence are transcribed differently, in that letters somewhat resembling the signs are used for the commonest, particularly for phonetic signs (*e.g.*, A for 159, U for 238), whilst others, particularly ideograms, are represented by the object they depict or its initial letters. The variants are shown by diacritic strokes. The texts are reproduced from left to right ; that is, they reproduce the seals, not the impressions.

The writer's main results may be summarised as follows :—

The single sign ˈ and the double sign ˈˈ are word-dividers and they are interchangeable.

Certain enclosing signs, particularly four small strokes arranged thus ˈ...ˈ, serve to emphasise certain ideograms or to surround certain signs which are generally used phonetically.

The most usual noun endings (given as A, U, Y (Ψ)—for Y, see p. 204, note 1) are case-endings (nominative, genitive and perhaps dative respectively).

The following word-signs are to be read thus :—

73–79 Stamp-mark (German Sté for Stémpel), with which the writer identifies variants 65–6 (German Ste), 114–16, 118, 120–22 (German Stê) and 147–8 (German Sté), is of peculiar interest on account of its frequent occurrence and of the light it throws on the texts ; *227–8* Mortar "corn" (German Mö for Mörser) ; *386* Load (Last) ; *387–8* ⁴Load "four-fold load" (German ⁴Last) ; *93a–96* Horse (Pf for Pferd) ; *163–67* Hoe (Hacke) ; *220, 223–4, 320* Scythe "the harvest, to reap" (Sense), thus *394* "reaper" and *392* "miller" ; *67–71* Grain (Getr for Getreide) ; *263* Seed (Same) ; *89–92* Pulse (Hüls for Hülsen) ; *293–95* and *253* Storehouse (Lag for Lager) ; *304–07* House (Haus) ; *308–9* Temple (Temp for Tempel) ; *322* Table (Tisch) ; *370, 372* Man (M for Mann) ; *378* Archer or Soldier (Bs for Bogenschutze) ; *377* Overseer (Aufs for Aufseher) ; *395–6* Officer (Off for Offizier). L. B. E.

The Monasteries of the Wadi 'n Natrûn : Part II. *The History of the Monasteries of Nitria and of Scetis.* 1932. Part III. *The Architecture and Archaeology.* 1933. By Hugh G. Evelyn White. Edited by Walter Hauser. Metropolitan Museum of Art : New York. $15 in paper ; $17.50 in boards.

The publication of these magnificent and beautifully illustrated volumes was made possible by the generosity of Mr. Edward Harkness. The very full MSS. left by Evelyn White at his untimely death have been most ably edited by Mr. Hauser. They constitute a remarkably complete account of a remote and interesting group of monasteries, to whose foundation is due the establishment of monasticism as a Christian institution. Their history is traced from the early fourth century down to the nineteenth with an astonishing wealth of anecdote and informative detail. In Part III, the ninety-three plates of plans and photographs are of great architectural and artistic interest. D. M.

The reviews of several important books have unfortunately to be held over owing to pressure on space. They include :—

Palaeolithic Man and the Nile Valley in Nubia and Upper Egypt. K. S. Sandford and W. J. Arkell. 1933. (Orient. Inst. Publications. Univ. of Chicago Press and Camb. Univ. Press.) *28s. 6d.*

Chalcolithic and Early Bronze Age Pottery of Megiddo. R. M. Engberg and G. M. Shipton. 1934. (Univ. of Chicago Press.) *7s.*

The Bucheum. Sir Robert Mond and O. H. Myers. 1934. (Oxford Univ. Press.) *42s.*

Ancient Egyptian Materials and Industries. A. Lucas. 1934. (E. Arnold and Co., London.) *16s.*

JOURNALS

BERYTHUS, I. 1934. Large 8vo., pp. 46, pls. 12. American Press, Beirut. Frs. 20.

We must welcome here a new archaeological annual, which may well grow in future.

SEYRIG, H.—*Invidiae Medici.*—This is a study of Gnostic amulets representing the ibis and serpent; these link on with the *eupepti* amulets. Another class has to do with St. Sisinnius and the protection of children. On a third kind is the figure of the reaper of tall corn, best figured in my *Amulets*, with the serpent of eternity around. The example here is inscribed *skhiōn*, perhaps as an amulet for reapers.

DEBEVOISE, N. C.—*Parthian and Sassanian Glyptic Art* deals with the various types of coarsely cut seal-stones of the Hellenistic period. Busts and animal figures are the most usual subjects.

NELSON, H. H.—*Egyptian Stone Vases from Byblos.*—These pieces of inscribed alabaster doubtless came from Pepy's temple. They were bought about ten years ago. The royal names are Ra·ded·ka, Tetu III, Pepy I, and Pepy II; and these pieces, some two dozen in number, show how richly the kings adorned the temple at the Sed Heb festivals.

CLAWSON, D.—*Phoenician Dental Art* describes how four loose front teeth were all lashed round with gold wire to retain them between two others in the lower jaw. This specimen from Sidon is compared with the more skilful Etruscan work, where gold bands, soldered together, clasped four molars and so secured four other replaced teeth.

INGHOLT, H.—*Palmyrene Sculptures in Beirut.*—An interesting series of seven inscribed busts is illustrated here. The period is from about A.D. 50 to 240. The cylindrical head-dress, sometimes wreathed, is shown to be that of a priest by its appearance on tesserae with the title "priest of Bel."

CHÉHAB, M.—*Trois stèles trouvées en Phénicie.*—One stele has a cornice of Uraei, under which are a globe and uraei. In the panel are two pillars, each crowned with a row of four uraei. A second stele has a male figure with right hand raised, beneath a winged globe. The third bears a tall bearded figure draped in Persian fashion, with right hand raised, adoring a globe on a crescent, the sun and moon or the full and crescent moon. Over the figure is a disc with one wing stretched over the worshipper; there is a row of rosettes above. F. P.

JOURNAL OF THE AMERICAN ORIENTAL SOCIETY. LIV. 169.

BERGMAN, A.—*Israelite Occupation of Eastern Palestine.*—This study is based on the territorial history, using the factors of geography and climate as controlling the historical changes. To the north, near the sources of the Jordan, are many early Bronze Age *tells*, and also in the Hauran. Egyptian steles of 1300 B.C. are found there; and many towns named in the Amarna letters and inscriptions, especially in Bashan on the Yarmak. Between that and the Jabbok, in Gilead, there was very little occupation. Further south, in Moab, there was early settlement; and beyond, in eastern Edom, there was also the attraction of copper mines. It appears that the Israelites first entered the less occupied regions, before attempting to conquer the cities. The regions of Gad and the half-tribe of Manasseh are correspondingly traced. There is a lack of the

historical unity in the accounts of this region, which are much less definite than in the history of Western Palestine. F. P.

QUARTERLY OF DEPT. OF ANTIQUITIES, PALESTINE; IV, 1 and 2. 1934 (London: Milford.) 5*s.* quarterly; 18*s.* 6*d.* for four parts.

R. W. HAMILTON.—*Excavations at Tell Abu Hawām.*—A well presented account of the excavation of a fortified settlement in the Kishon valley, with plans and thirty-nine plates. Four main periods of construction are shown, from the latter part of the Late Bronze Age to the Graeco-Persian period (late VIth to early IVth century B.C.). The crises in the history of this settlement indicated by the dismantling of walls and by conflagrations appear to coincide with the invasions of Rameses II, Merneptah, Rameses III and Shishak I (c. 926 B.C.). After its destruction by Shishak, the site seems to have been deserted for several centuries. It was reoccupied for a comparatively short period in Graeco-Persian times, but it was of little importance and seems to have been finally superseded by Haifa.

J. H. ILIFFE.—*Cemeteries and a "Monastery" at the Y.M.C.A., Jerusalem.*—An account of ancient tombs and part of a building of V–VIIth century date excavated at the clearance of a sports ground for the Y.M.C.A. An inscription which probably dates from the first half of the VIth century A.D. mentions the Bishop of the Georgians and the Tower of David. D. M.

SYRIA; XV, 2. 1934. (Paris: Paul Geuthner.) 150 frs.

C. F. A. SCHAEFFER.—*Les Fouilles de Ras-Shamra, Cinquième Campagne (Printemps 1933).*—Excavations made at the foot of the *tell* to clear a space for dumping revealed several tombs which had been robbed anciently. The types of pottery found in the third stratum examined suggest a common ancestry with the painted wares of Iran and Mesopotamia. In further excavations north, south and west of the Temple and Library there were found several interesting inscriptions, tombs of the XIIIth century B.C., and remains of the Egyptian Middle Kingdom. Further evidence was forthcoming for the identification of Ras-Shamra with Ugarit of the Tell el-Amarna documents; local folklore also localises at Ras-Shamra the ancient capital of the country. Though the site has been searched for treasure as far back as Greek and Roman times—and by the Turks more recently—a remarkably fine gold cup and dish were unearthed that were evidently part of a hastily buried *cache*. They had probably belonged to the Temple and are dated by their style to the first rather than the second half of the XIVth century B.C. They are evidently of Syrian or Phoenician workmanship. Notes on inscriptions are by Montet, Virolleaud and Thureau-Dangin.

M. HENRI SEYRIG.—*Bas-reliefs monumentaux du temple de Bêl à Palmyre.*—These reliefs—the oldest in Palmyra—date from the building of the Temple of Baal which was dedicated in 32 A.D. They picture gods and a goddess, priests making offerings, a sanctuary, and monsters whose extremities were serpents or those of fish. A certain Graeco-Roman influence is evident, but the sculpture is entirely oriental in its flatness, the lowness of the relief, and the lack of perspective and of composition. Its most interesting feature is the full-faced mode of portraying the human figure, which no doubt was learned from the Parthians, who were close neighbours of the region where developed the Graeco-Buddhist art of which this was characteristic. Through Palmyra, it appears, the full-faced mode of portraiture was passed on to the West. D. M.

NOTES AND NEWS.

At University College, London, on November 23rd, Colonel Sir Henry Lyons, F.R.S., on behalf of the subscribers, presented to the College a portrait of Sir Flinders Petrie in commemoration of his forty years' tenure of the Edwards Chair of Egyptology—the first Chair of Egyptology to be founded within the British Empire. This fine portrait was painted by Mr. Philip de Laszlo. A sufficient sum had been subscribed to include also a cheque that has been presented to Sir Flinders Petrie himself, to be devoted to whatever aspect of his work he may wish.

Despite his long and magnificent record of archaeological work in the Near East, Sir Flinders Petrie has this season undertaken a new search for the origins of the advanced civilisation which he has studied in recent years in Southern Palestine. Convinced that this civilisation came from the north, Sir Flinders Petrie, by courtesy of the French authorities in Syria, is now making a survey of northern Syria with a view to finding sites the excavation of which would be likely to throw light on the problem. It is to be hoped that the subscriptions this year to the British School of Archaeology in Egypt will be as generous as ever, despite the change of field that has in recent years removed the work of the school from within the confines of Egypt.

At the same time, the British School of Archaeology in Iraq is similarly widening its field of research beyond the frontiers of that country. Unhappily this is not only at the demand of scientific inquiry, for the fear that unacceptable conditions are to be imposed by the Iraqi authorities on archaeological research seem once more in danger of being justified. Mr. Mallowan is now engaged upon a survey of the east bank of the river Khabur to find evidence of the connections of Syria with Assyria and Babylonia which may be expected from the recent great discoveries in Mesopotamia.

While the links connecting Egypt and Southern Palestine on the one hand and Babylonia and Assyria on the other with Syria are thus being sought out, the contacts between the Indus valley civilisation and Sumer and Iran are also to be studied. It is announced in the *Journal of the American Oriental Society* (September, 1934) that the recently organised American School of Indic and Iranian Studies "will co-operate with the Museum of Fine Arts of Boston in a joint excavation of a site in the Indus Valley as soon as a concession has been secured from the proper authorities in England and in India." The great importance of this latter field of investigation is apparent from the growing evidence of a lively trade between the countries. Seals and other objects of Indian origin have been found in considerable numbers in the Sumerian cities, and articles of foreign origin at Mohenjo-daro. The remarkable explorations of Sir Aurel Stein in Baluchistan and Persia have also revealed ancient remains of contemporary date, the further excavation of which should prove most fruitful in results.

Since the last number of this journal went to press, the British School of Archaeology in Iraq has produced the first two numbers of its fine journal *Iraq*, which is cordially welcomed by all who have the interests of archaeology at heart. The publication of the valuable discoveries of trained field-workers in the East cannot be carried forward too rapidly.

OBITUARY.

Kurt Sethe.

English Egyptology has suffered many losses during the course of this year, and now it is the turn of Germany to mourn the death of one of her greatest scholars, Kurt Sethe. Following the lead of his great master, Erman, Sethe produced his monumental work *Das Aegyptische Verbum*, a work which almost more than any other has placed the study of the Egyptian language on a sound and secure basis. All modern knowledge of ancient Egyptian is founded on those twin masterpieces, Erman's *Grammatik* and Sethe's *Verbum*. Sethe's speciality was the early form of the language, and his edition of the Pyramid Texts must be the authoritative rendering for years to come. It is a matter of deep regret that his translations of those texts were so fragmentary; had he only completed even a tentative translation he would have conferred a great boon on posterity. Latterly he devoted much time to the study of Egyptian phonetics, a difficult subject in which few are fit to follow him. In Sethe, Egyptology has lost one of its most eminent workers; his death leaves a blank in the world of scholars which can never be filled. M. A. Murray.

Professor A. S. Hunt.

By the death of Professor A. S. Hunt, English papyrology loses the last of its founders, who for nearly forty years had maintained a steady output of publication of the highest value to students of the Hellenistic and Roman periods. He was a brilliant scholar and tireless worker; and the series of volumes issued by the Egypt Exploration Society, in the earlier of which he bore an equal share with Bernard Grenfell and for the latter was almost entirely responsible, represent an achievement which few men can rival. At the same time he was always ready to help and advise anyone engaged in research of a similar kind, and placed his stores of knowledge freely at the disposal of enquirers: and in private life he was the kindest of friends. In him the scholar and the gentleman were happily blended. J. G. Milne.